Agilent 1290 Infinity II Flexible Pump

User Manual

Agilent Technologies

Notices

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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

In This Guide...

This manual covers the Agilent 1290 Infinity II Flexible Pump (G7104A).

1 Introduction

This chapter gives an introduction to the module, instrument overview and internal connectors.

2 Site Requirements and Specifications

This chapter provides information on environmental requirements, physical and performance specifications.

3 Using the Pump

This chapter explains the operational parameters of the Agilent 1290 Infinity II Flexible Pump.

4 How to Optimize the Performance of Your Module

This chapter gives hints on how to optimize the performance or use additional devices.

5 Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.

6 Error Information

This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

7 Maintenance

This chapter describes the maintenance of the Agilent 1290 Infinity II Flexible Pump.

8 Parts and Materials

This chapter provides information on parts for maintenance and repair.

9 Identifying Cables

This chapter provides information on cables used with the modules.

10 Hardware Information

This chapter describes the pump in more detail on hardware and electronics.

11 LAN Configuration

This chapter provides information on connecting the module to the controller software.

12 Appendix

This chapter provides additional information on safety, legal and web.

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1 Introduction

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This chapter gives an introduction to the module, instrument overview and internal connectors.

Product Description

The Agilent 1290 Infinity II Flexible Pump improves your efficiency by combining the performance of a high-pressure mixing UHPLC pump with the flexibility of a low-pressure mixing UHPLC pump.

The new 1290 Infinity II LC power range has a high instrument efficiency, allowing you to run any HPLC and UHPLC method. ISET enables you to transfer existing methods from different instrument modules - current Agilent systems as well as instruments from other manufacturers.

The Agilent Inlet Weaver mixer, active damping or the optional Agilent V380 Jet Weaver mixer for additional mixing capacity achieve high analytical efficiency.

The established multipurpose valve enhances laboratory efficiency by adding useful functionalities, for example, mixer in/out switch, filter backflush or automatic purge, and BlendAssist software simplifies your workflow with accurate buffer/additive blending.

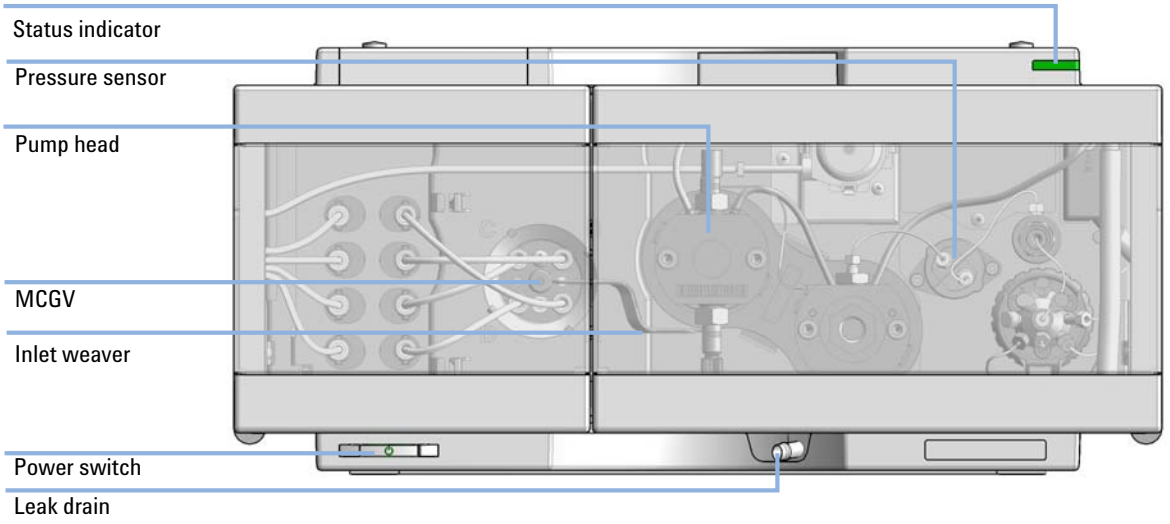

Figure 1 Overview of the Flexible Pump

Features

- High performance in terms of accuracy and precision for flow and composition.
- High power range combining high pressure up to 1300 bar and high analytical flow rates up to 5 mL/min for high chromatographic performance.
- Integrated high efficiency degasser with low internal volume is based on PTFE AF technology and has a fast change-over of solvents for purging and priming the pump.
- High solvent mixing efficiency before reaching the pump head due to the established Inlet Weaver technology.
- Active damping with independently controllable high resolution pump drives and firmware-embedded tuning algorithms significantly reduce ripples and associated UV noise, switchable V380 Jet Weaver for extra mixing volume.
- A multipurpose valve enables automatic software-embedded functionalities such as switching the optional mixer in and out, flushing back the inline filter or automatic purging.
- The unique Intelligent System Emulation Technology (ISET) enables the emulation of existing Agilent 1100, 1200 and 1260 Infinity Series instruments, as well as Waters Alliance, Waters H-Class and Shimadzu Prominence instruments.
- Precise and accurate buffer/additive blending using the new software feature BlendAssist, implemented in the pump driver.
- Built-in active seal-wash for increased uptime.

Operating Principle

The pump head comprises two pump chambers in series with independent high-resolution motion control. A pressure sensor in the flow path monitors the pressure. The pump control uses this signal for minimizing the pressure ripple in order to achieve highest flow precision. A stable flow can be delivered even in case of eventual small internal leaks, which can be compensated automatically. A heat exchanger between two pump chambers strongly reduces thermal effects due to solvent compression under very high pressures.

As solvents are compressed by the pump head and expand further down the flow path, for example in the column, the volumetric flow is changed depending on the compressibility of the liquid. Agilent control software allows specifying pure solvents, pre-mixed solvents and solvent gradients. Associated Agilent solvent libraries are used by the pump control for enhanced flow accuracy, which is required for cross-instrument or cross-system reproducibility and method compatibility.

A high resolution encoder unit is attached to the pump drives, which divides a single turn into 65000 steps. Each step corresponds to a volume of about 300 pL, which allows an extremely precise control.

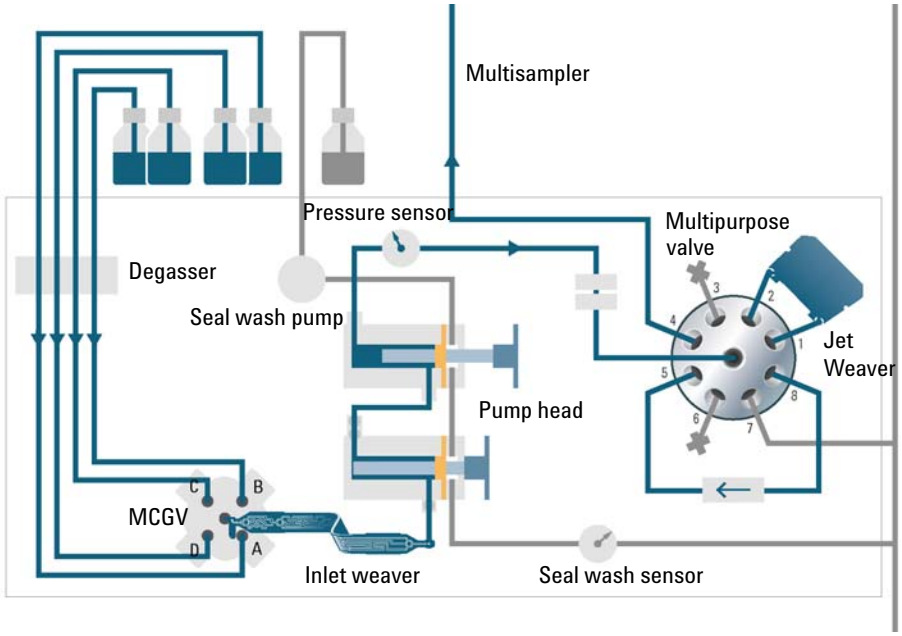

Figure 2 The hydraulic path

Positions of the Multi Purpose Valve

The Multi Purpose Valve allows easy software controlled switching between different modes of operation.

Normal Operating Mode Without Mixer

In normal operating mode, the flow comes from the pump head, passes the pressure sensor and arrives at the central port of the Multi Purpose Valve. The flow passes the inline filter and leaves the valve through port 4 to the system (autosampler etc.).

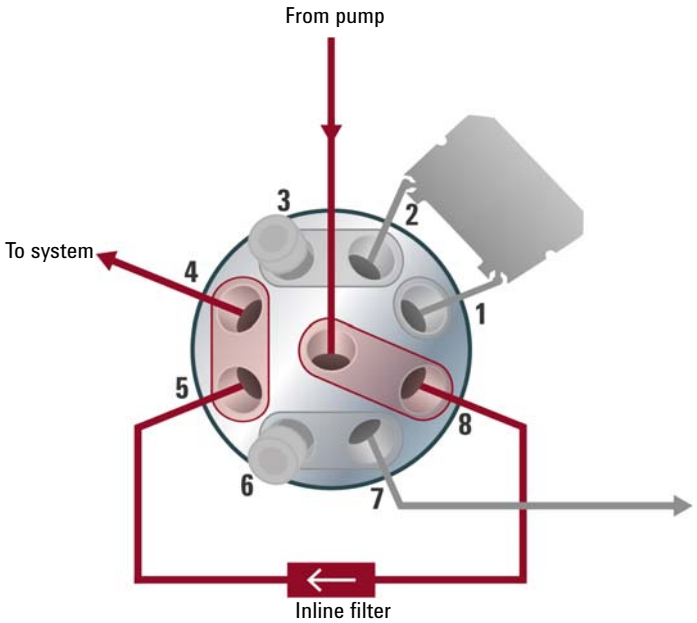

Figure 3 Valve position in normal operating mode without mixer

Purge Mode

In purge mode, the flow is diverted to the waste container.

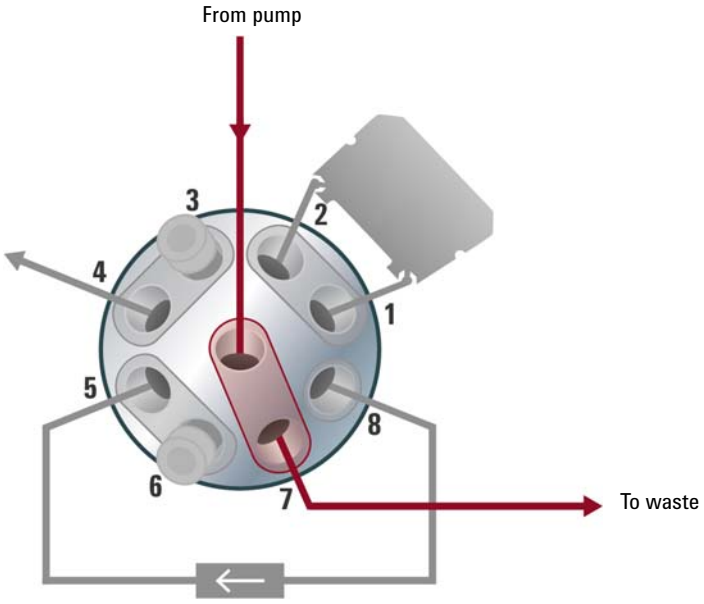

Figure 4 Valve position in purge mode

Normal Operating Mode With Mixer

In this mode, the flow passes an optional Jet Weaver and the inline filter. This configuration is recommended for special applications which require an increased mixing efficiency.

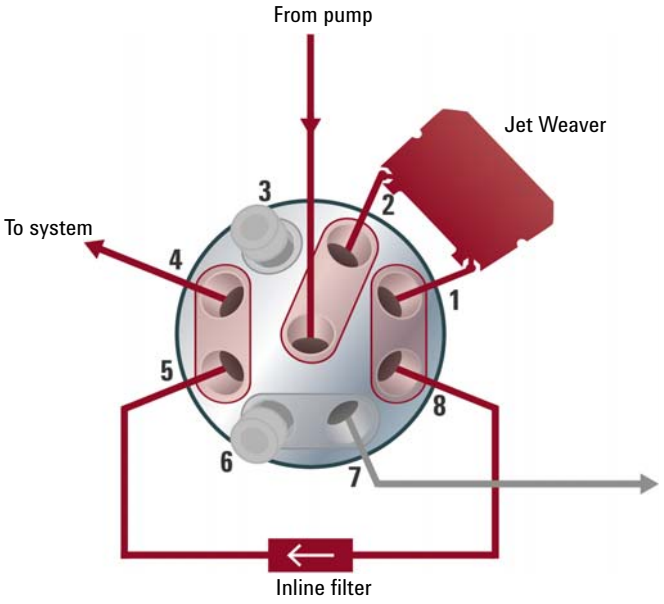

Figure 5 Valve position in normal operating mode with mixer

Filter Flush Mode

This mode is used for cleaning the inline filter by back-flushing it. The flow goes to port 5, passes the inline filter in opposite direction and leaves to the waste through port 7.

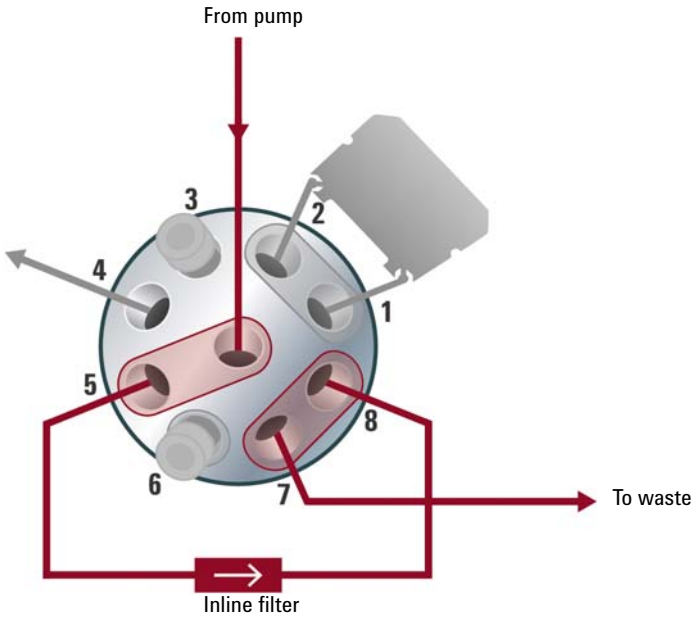

Figure 6 Valve position in filter flush mode

Service Mode

In service mode, the flow is diverted to port 3, where for example a restriction capillary can be installed for diagnostic tests.

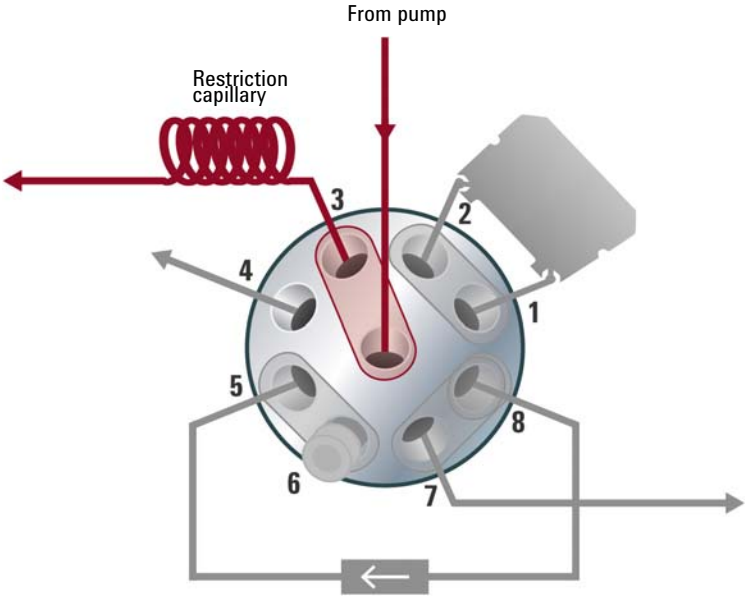

Figure 7 Valve position in service mode

Leak and Waste Handling

The 1290 Infinity II Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

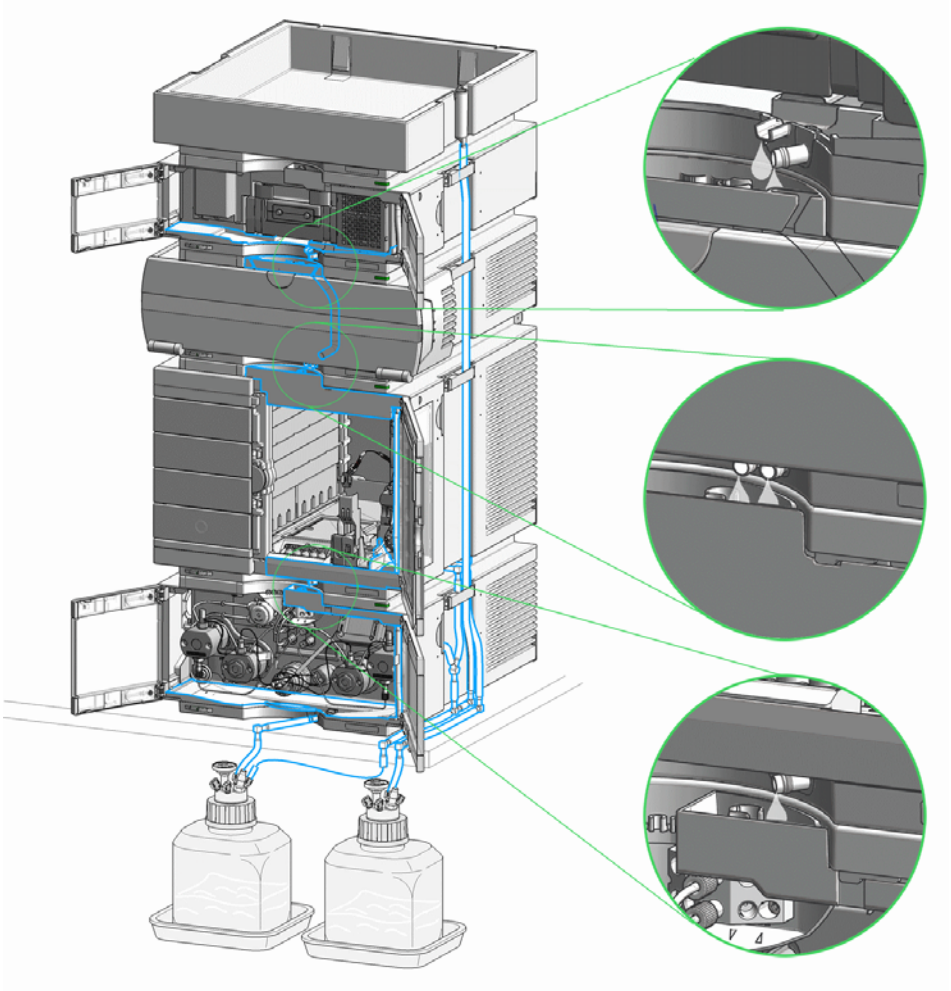

Figure 8 Leak and waste handling concept (overview - typical stack configuration as an example)

The solvent cabinet is designed to store a maximum volume of 6 L solvent. The maximum volume for an individual bottle stored in the solvent cabinet should not exceed 4 L. For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets (a printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet).

All leak plane outlets are situated in a consistent position so that all Infinity and Infinity II modules can be stacked on top of each other. Waste tubes are guided through a channel on the right hand side of the instrument, keeping the front access clear from tubes.

The leak plane provides leak management by catching all internal liquid leaks, guiding them to the leak sensor for leak detection, and passing them on to the next module below, if the leak sensor fails. The leak sensor in the leak plane stops the running system as soon as the leak detection level is reached.

Solvent and condensate is guided through the waste channel into the waste container:

- from the detector's flow cell outlet
- from the Multisampler needle wash port
- from the Sample Cooler (condensate)
- from the Seal Wash Sensor
- from the pump's Purge Valve or Multipurpose Valve

The waste tube connected to the leak pan outlet on each of the bottom instruments guides the solvent to a suitable waste container.

Waste Concept

Agilent recommends using the 6 L waste can with 1 Stay Safe cap GL45 with 4 ports (5043-1221) for optimal and safe waste disposal. If you decide to use your own waste solution, make sure that the tubes don't immerse in the liquid.

2
Site Requirements and Specifications

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Performance Specifications 28

This chapter provides information on environmental requirements, physical and performance specifications.

Site Requirements

A suitable environment is important to ensure optimal performance of the instrument.

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 1 on page 27. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Hazard of electrical shock or damage of your instrumentation

can result, if the devices are connected to a line voltage higher than specified.

➔ Connect your instrument to the specified line voltage only.

WARNING

The module is partially energized when switched off, as long as the power cord is plugged in.

Repair work at the module can lead to personal injuries, e.g. electrical shock, when the cover is opened and the module is connected to power.

➔ Always unplug the power cable before opening the cover.

➔ Do not connect the power cable to the instrument while the covers are removed.

CAUTION

Inaccessible power plug.

In case of emergency it must be possible to disconnect the instrument from the power line at any time.

➔ Make sure the power connector of the instrument can be easily reached and unplugged.

➔ Provide sufficient space behind the power socket of the instrument to unplug the cable.

Power Cords

Different power cords are offered as options with the module. The female end of all power cords is identical. It plugs into the power-input socket at the rear. The male end of each power cord is different and designed to match the wall socket of a particular country or region.

WARNING

Absence of ground connection or use of unspecified power cord

The absence of ground connection or the use of unspecified power cord can lead to electric shock or short circuit.

➔ Never operate your instrumentation from a power outlet that has no ground connection.

➔ Never use a power cord other than the Agilent Technologies power cord designed for your region.

WARNING

Use of unsupplied cables

Using cables not supplied by Agilent Technologies can lead to damage of the electronic components or personal injury.

➔ Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

WARNING

Unintended use of supplied power cords

Using power cords for unintended purposes can lead to personal injury or damage of electronic equipment.

➔ Never use the power cords that Agilent Technologies supplies with this instrument for any other equipment.

Bench Space

The module dimensions and weight (see Table 1 on page 27) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

If the bench shall carry a complete HPLC system, make sure that the bench is designed to bear the weight of all modules.

The module should be operated in a horizontal position.

Condensation

CAUTION

Condensation within the module

Condensation can damage the system electronics.

➔ Do not store, ship or use your module under conditions where temperature fluctuations could cause condensation within the module.

➔ If your module was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	16.1 kg (35.5 lbs)	
Dimensions (height × width × depth)	180 x 396 x 436 mm (7.1 x 15.6 x 17.2 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	120 VA / 110 W	
Ambient operating temperature	4 – 55 °C (39 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 95 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
Non-operating altitude	Up to 4600 m (15092 ft)	For storing the module
Safety standards: IEC, EN, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.

Performance Specifications

Table 2 Agilent 1290 Infinity II Flexible Pump (G7104A) Performance Specifications

Feature	Specification
Hydraulic system	Dual pistons in series pump with proprietary servo-controlled variable stroke design and smooth motion control for active damping.
Pump resolution step size	300 pL step size
Settable flow range	0.001 – 5 mL/min, in 0.001 mL/min increments (executed in 300 pL/step increments).
Flow precision	≤0.07 % RSD or 0.01 min SD, whatever is greater
Flow accuracy	±1 % or ±10 µL/min, whatever is greater
Pressure range	up to 130 MPa (1300 bar) at 0 – 2 mL/min ramping down to 80 MPa (800 bar) at 5 mL/min
Pressure pulsation	<1 % amplitude or <0.5 MPa (5 bar), whatever is greater
Compressibility compensation	Automatic
Recommended pH-range	1.0 – 12.5, solvents with pH <2.3 should not contain acid which attack stainless steel.
Gradient formation	Low pressure quaternary mixing
Delay volume	As low as 350 µL
Composition range	Settable range: 0 – 100 % Recommended range: 1 – 99 % or 5 µL/min
Composition precision	<0.15 % RSD or 0.02 min SD, whatever is greater
Composition accuracy	±0.4 % absolute (1 – 99 % B)
Number of solvent	4 out of maximum 26 solvents

Table 2 Agilent 1290 Infinity II Flexible Pump (G7104A) Performance Specifications

Feature	Specification
Solvent selection valve	Internal 4-solvent gradient formation valve included. External 2x 12 solvent valve as option, fully integrated in the pump control interface.
Degassing unit	Integrated. Number of channels: 4, Internal volume per channel: 1.5 mL
Materials in contact with solvent	TFE/PDD copolymer, FEP, PEEK, PPS, stainless steel, polyimide
Automatic Purge Valve	Included, allows automatic inline-filter back-flush and automatic mixer change, e.g. for optional TFA-mixer
Active Seal wash	Included
Intelligent System Emulation Technology (ISET)	Included
Communications	Controller-area network (CAN), RS232C, APG remote: ready, start, stop and shutdown signals, LAN
Safety and maintenance	Extensive diagnostics, error detection and display through included Agilent LabAdvisor, leak detection, safe leak handling, leak output signal for shutdown of the pumping system. Low voltage in major maintenance areas.
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of seal wear and volume of pumped mobile phase with pre-defined and user settable limits and feedback messages. Electronic records of maintenance and errors.
Housing	All materials are recyclable.

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Using the Pump

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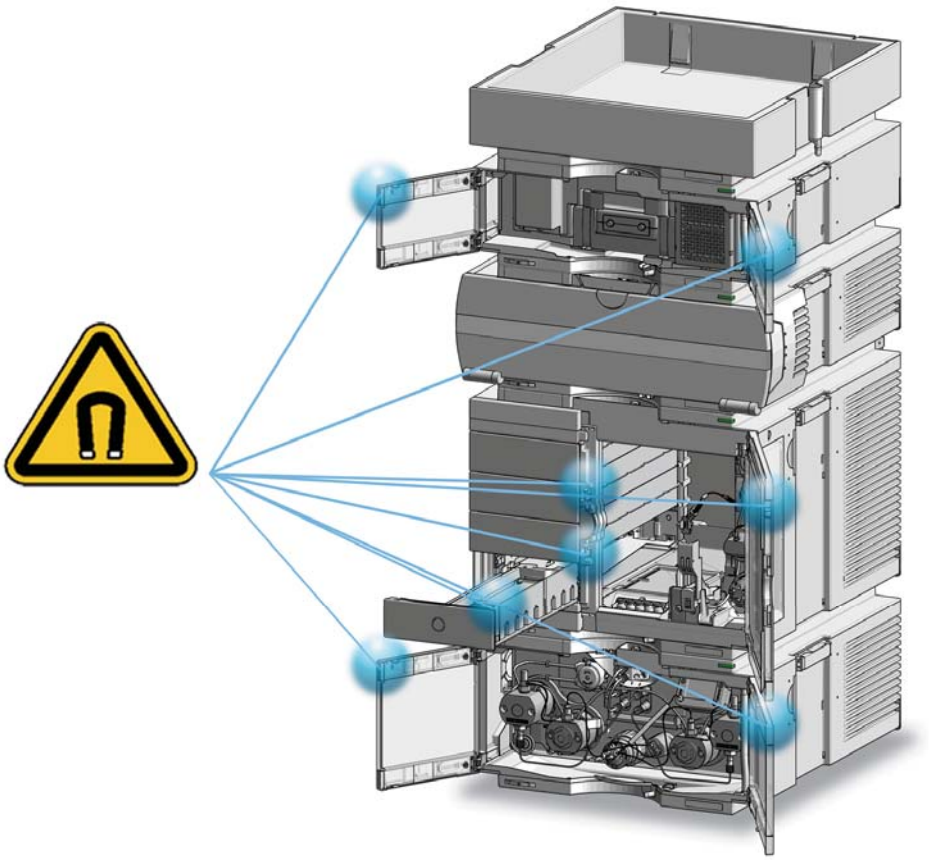
- Prepare the pump 36
- How to deal with solvents 37
- Select channels for Multi-Channel Gradient Valve (MCGV) 37

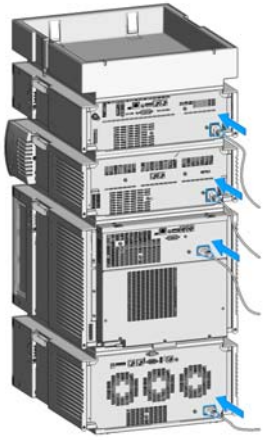
This chapter explains the operational parameters of the Agilent 1290 Infinity II Flexible Pump.

Magnets

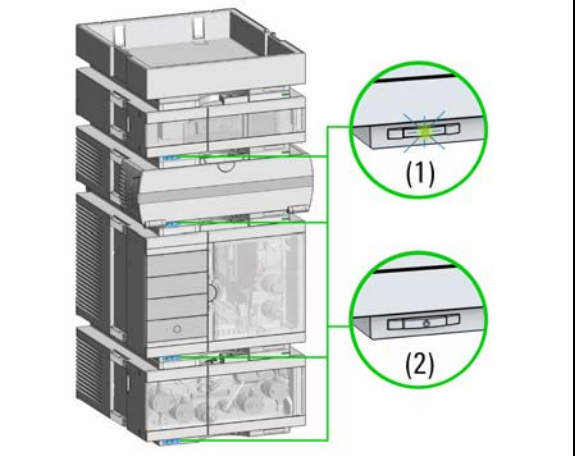


Turn on/off

1



2

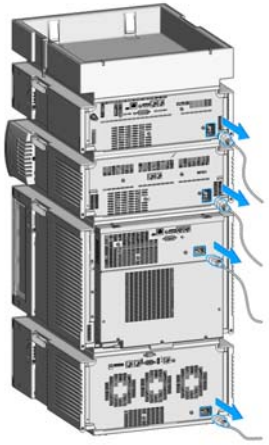


Power switch

(1) On

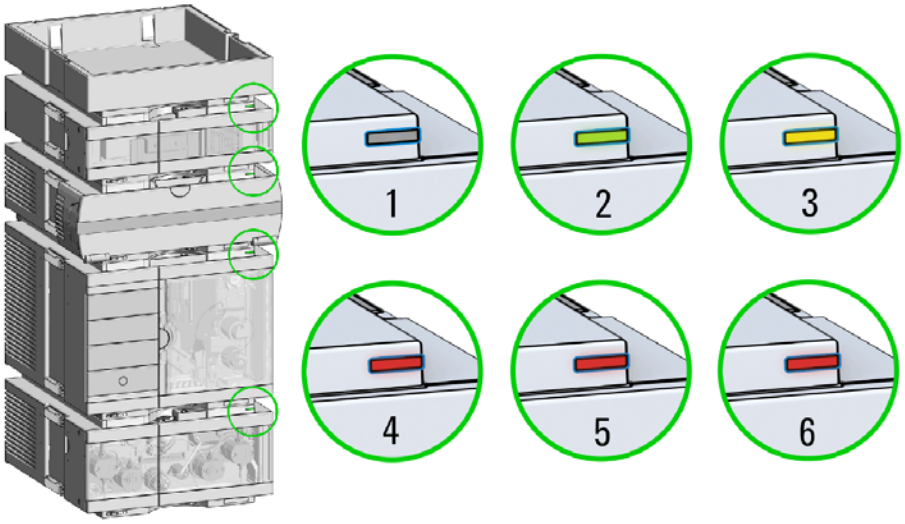
(2) Off

3



Status Indicators

The module status indicator indicates one of six possible module conditions:



Status indicators

1. Idle

2. Run mode

3. Not-ready. Waiting for a specific pre-run condition to be reached or completed.

4. Error mode - interrupts the analysis and requires attention (for example a leak or defective internal components).

5. Resident mode (blinking) - for example during update of main firmware.

6. Bootloader mode (fast blinking). Try to re-boot the module or try a cold-start. Then try a firmware update.

Best Practices

Daily / Weekly tasks

Daily tasks

- Replace mobile phase based on water/buffer.
- Replace organic mobile phase latest every 2nd day.
- Check seal wash solvent.
- Run conditioning with composition of your application.

Weekly tasks

- Change seal wash solvent (10 % / 90 % isopropanol/water) and bottle.
- Flush all channels with water to remove salt deposits.
- Visually inspect solvent filters. Clean or exchange if necessary.

Power up / Shut-down the pump

Power up the pump

- Use new or different mobile phase (as required).
- Purge pump heads with 2.5 – 3 mL/min for 5 min.
- Condition pump heads for 10 – 20 min.

Long-term shut-down of the pump

- Flush system with water to remove buffer.
- Use recommended solvents to store the system.
- Power off the pump or system.

Prepare the pump

Purge

Use the Purge function to:

- fill the pump,
- exchange a solvent,
- remove air bubbles in tubes and pump heads.

Condition

Use the Conditioning function:

- daily when starting the pump,
- to minimize pressure ripple by dissolving air bubbles in pump heads.

NOTE Condition your complete system with solvents and composition of your application (for example 50 %/50 % A/B at 0.5 mL/min.

Seal wash

The seal wash function runs continuously and is controlled by the seal wash sensor. This guarantees a maximum seal life time.

CAUTION Contaminated seal wash solvent

➔ Do not recycle seal wash solvent to avoid contamination.

➔ Weekly exchange seal wash solvent.

How to deal with solvents

- Use clean bottles only.
- Exchange water-based solvents daily.
- Select solvent volume to be used up within 1 – 2 days.
- Use only HPLC-grade solvents and water filtered through 0.2 µm filters.
- Label bottles correctly with bottle content, and filling date / expiry date.
- Use solvent inlet filters.
- Reduce risk of algae growth: use brown bottles for aqueous solvents, avoid direct sunlight.

Select channels for Multi-Channel Gradient Valve (MCGV)

- Use lower channels (A and/or D) for buffer solutions.
- Regularly flush all MCGV channels with water to remove possible salt deposits.
- Check compatibility of buffers and organic solvents to avoid precipitation.

4
How to Optimize the Performance of Your Module

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Using Solvent Calibration Tables 46

This chapter gives hints on how to optimize the performance or use additional devices.

Delay Volume and Extra-Column Volume

The *delay volume* is defined as the system volume between the point of mixing in the pump and the top of the column.

The *extra-column volume* is defined as the volume between the injection point and the detection point, excluding the volume in the column.

Delay Volume

In gradient separations, this volume causes a delay between the mixture changing in the pump and that change reaching the column. The delay depends on the flow rate and the delay volume of the system. In effect, this means that in every HPLC system there is an additional isocratic segment in the gradient profile at the start of every run. Usually the gradient profile is reported in terms of the mixture settings at the pump and the delay volume is not quoted even though this will have an effect on the chromatography. This effect becomes more significant at low flow rates and small column volumes and can have a large impact on the transferability of gradient methods. It is important, therefore, for fast gradient separations to have small delay volumes, especially with narrow bore columns (e.g., 2.1 mm i.d.) as often used with mass spectrometric detection.

The delay volume in a system includes the volume in the pump from the point of mixing, connections between pump and autosampler, volume of the flow path through the autosampler and connections between autosampler and column.

For the 1290 Infinity II Flexible Pump, all pump parts downstream the MCGV contribute to the delay volume, i.e. inlet weaver, pump heads, capillary connections, filters and the optional Jet Weaver.

How to Configure the Optimum Delay Volume

The design of the 1290 Infinity Quaternary Pump offers a strongly decreased delay volume compared to standard 600 bar pressure pumps. For the 1290 Infinity Quaternary Pump, mixing is done in the multi-channel gradient valve at ambient pressure. As all pump parts in the flow path after mixing contribute to the delay volume, this includes also pump heads of the quaternary pump, flow connections, filters, mixers etc. Therefore the delay volume of a quaternary pump is by design larger than that of a binary pump.

All listed components including the inlet weaver and pump heads ensure a good mixing performance resulting in excellent composition precision and accuracy, highly reproducible retention times and low baseline noise. This ensures best results for most applications.

Per default, the 1290 Infinity Quaternary Pump does not require and include a Jet Weaver, as solvents are mixed in the MCGV and mixing is further improved in the inlet weaver, pump heads and subsequent parts in the flow path. Therefore, no Jet Weaver is required for most applications.

The V380 Jet Weaver high performance mixer is optionally available for demanding applications, which use solvents in different channels (for example A versus B), that differ strongly in their UV/Vis absorption, for example by using trifluoroacetic acid (TFA) as a modifier, which has a high absorbance. Solvent packages created by the pump may persist until the solvent reaches the detector flow cell. Absorption fluctuations can then show up as baseline noise, also referred to as mixing noise. Applications like impurity quantitation or lowest level compound detection require minimizing this noise. The V380 Jet Weaver strongly improves mixing and therefore reduces baseline noise and improves sensitivity in detection. Patented Agilent microfluidic technology offers high mixing performance at a low internal volume of 380 µL, which is the physical volume of all channels. It contributes with 150 µL to the pump delay volume (< 350 µL without Jet Weaver), which is the partial mixer volume that creates a composition change corresponding to the delay volume.

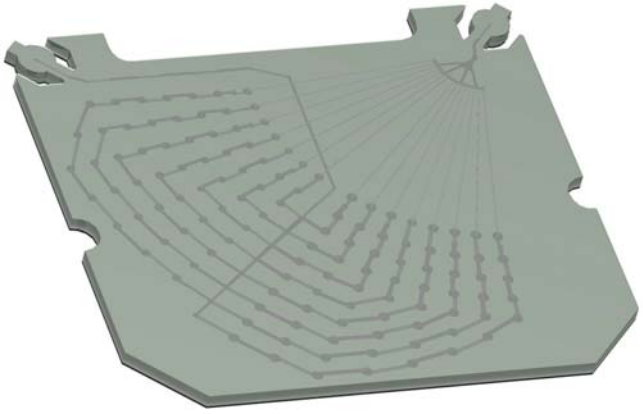

Figure 9 The Jet Weaver mixer

The installation procedure is illustrated in “Install the Jet Weaver” on page 97.

How to Achieve Higher Resolution

Increased resolution in a separation will improve the qualitative and quantitative data analysis, allow more peaks to be separated or offer further scope for speeding up the separation. This section explains how resolution can be increased by examining the following points:

- Optimize selectivity
- Smaller particle-size packing
- Longer Columns
- Shallower gradients, faster flow

Resolution between two peaks is described by the resolution equation:

$$Rs = \frac{1}{4}\sqrt{N}\,\frac{(\alpha - 1)}{\alpha}\,\frac{(k_2 + 1)}{k_2}$$

where

- R_S=resolution,
- N=plate count (measure of column efficiency),
- α=selectivity (between two peaks),
- k_2=retention factor of second peak (formerly called capacity factor).

The term that has the most significant effect on resolution is the selectivity, α, and practically varying this term involves changing the type of stationary phase (C18, C8, phenyl, nitrile etc.), the mobile phase and temperature to maximize the selectivity differences between the solutes to be separated. This is a substantial piece of work which is best done with an automated method development system which allows a wide range of conditions on different columns and mobile phases to be assessed in an ordered scouting protocol. This section considers how to get higher resolution with any chosen stationary and mobile phases. If an automated method development system was used in the decision on phases it is likely that short columns were used for fast analysis in each step of the scouting.

The resolution equation shows that the next most significant term is the plate count or efficiency, N, and this can be optimized in a number of

ways. N is inversely proportional to the particle size and directly proportional to the length of a column and so smaller particle size and a longer column will give a higher plate number. The pressure rises with the inverse square of the particle size and proportionally with the length of the column. This is the reason that the 1290 Infinity LC system was designed to go to 1200 bar so that it can run sub-two-micron particles and column length can be increased to 100 mm or 150 mm. There are even examples of 100 mm and 150 mm columns linked to give 250 mm length. Resolution increases with the square root of N so doubling the length of the column will increase resolution by a factor of 1.4. What is achievable depends on the viscosity of the mobile phase as this relates directly to the pressure. Methanol mixtures will generate more back pressure than acetonitrile mixtures. Acetonitrile is often preferred because peak shapes are better and narrower in addition to the lower viscosity but methanol generally yields better selectivity (certainly for small molecules less than about 500 Da). The viscosity can be reduced by increasing the temperature but it should be remembered that this can change the selectivity of the separation. Experiment will show if this leads to increase or decrease in selectivity. As flow and pressure are increased it should be remembered that frictional heating inside the column will increase and that can lead to slightly increased dispersion and possibly a small selectivity change both of which could be seen as a reduction in resolution. The latter case might be offset by reducing the temperature of the thermostat by a few degrees and again experiment will reveal the answer.

The van Deemter curve shows that the optimum flow rate through an STM column is higher than for larger particles and is fairly flat as the flow rate increases. Typical, close to optimum, flow rates for STM columns are: 2 ml/min for 4.6 mm i.d.; and 0.4 ml/min for 2.1 mm i.d. columns.

In isocratic separations, increasing the retention factor, k, results in better resolution because the solute is retained longer. In gradient separations the retention is described by k^* in the following equation:

$$k^* = \frac{t_G}{\Delta\%B} \cdot \frac{F}{V_m} \cdot \frac{100}{S}$$

where:

- k^* = mean k value,
- t_G = time length of gradient (or segment of gradient) (min),

- F = flow (ml/min),
- V_m = column delay volume,
- Δ%B = change in fraction of solvent B during the gradient,
- S = constant (ca. 4-5 for small molecules).

This shows that k and hence resolution can be increased by having a shallower gradient (2 to 5 %/min change is a guideline), higher flow rate and a smaller volume column. This equation also shows how to speed up an existing gradient – if the flow is doubled but the gradient time is halved, k^* remains constant and the separation looks the same but happens in half the time. Recently published research has shown how a shorter STM column (at temperatures above 40 °C) can generate higher peak capacity than a longer STM column by virtue of running it faster. (Refer to *Petersson et al., J.Sep.Sci, 31, 2346-2357, 2008, Maximizing peak capacity and separation speed in liquid chromatography*).

Using Solvent Calibration Tables

Importing Solvent Calibration Tables

RC.NET based Agilent graphical user interfaces (ChemStation, EZChrom Elite, OpenLab etc.) include data for most commonly used solvents in HPLC. This data contains solvent properties and is used for optimum pump control in order to ensure best flow and composition accuracy.

If your solvent is not included to the software, please check the Agilent web site
http://www.chem.agilent.com/en-US/Support/Downloads/firmware/Pages/LC.aspx
for additional libraries (registration required), which also provides updates and optimized data.

If your solvent is neither available in the user interface nor in the library, please use generic solvents. "Generic aequeous" gives good results for most solvent mixtures with at least 50 % water, which have similar properties as pure water. For other solvents with high organic percentage, "Generic organic" gives a good approximation.

Importing Solvent Calibration in ChemStation

1. Go to menu **Instrument > Instrument configuration**.
2. In the **Instrument Configuration** screen choose your module and click **Configure**.
3. Click **Configure Solvent Type Catalogs**.
4. In **Solvent Type Catalogs** click **Import**.
5. Navigate to the location of the solvent calibration table and click **Open**.
6. The new solvent will now appear in the **Solvent Type Catalogs**.

5
Troubleshooting and Diagnostics

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Overview about the troubleshooting and diagnostic features.

User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary.
- Preferred tool should be Agilent Lab Advisor Software, see "Agilent Lab Advisor Software" on page 49.
- The Agilent OpenLab ChemStation C.01.03 and above do not include any maintenance/test functions.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

Agilent Lab Advisor Software

The Agilent Lab Advisor Software is a standalone product that can be used with or without chromatographic data system. Agilent Lab Advisor helps to manage the lab for high-quality chromatographic results by providing a detailed system overview of all connected analytical instruments with instrument status, Early Maintenance Feedback counters (EMF), instrument configuration information, and diagnostic tests. By the push of a button, a detailed diagnostic report can be generated. Upon request, the user can send this report to Agilent for a significantly improved troubleshooting and repair process.

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

Lab Advisor Basic is included with every Agilent 1200 Infinity Series and Infinity II Series pump.

The Lab Advisor Advanced features can be unlocked by purchasing a license key, and include real-time monitoring of instrument actuals, all various instrument signals, and state machines. In addition, all diagnostic test results, calibration results, and acquired signal data can be uploaded to a shared network folder. The Review Client included in Lab Advisor Advanced allows to load and examine the uploaded data no matter on which instrument it was generated. This makes Data Sharing an ideal tool for internal support groups and users who want to track the instrument history of their analytical systems.

The optional Agilent Maintenance Wizard Add-on provides an easy-to-use, step-by-step multimedia guide for performing preventive maintenance on Agilent 1200 Infinity and Infinity II Series instruments.

The tests and diagnostic features that are provided by the Agilent Lab Advisor software may differ from the descriptions in this manual. For details, refer to the Agilent Lab Advisor software help files.

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Error Information

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This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

What Are Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs which requires attention before the analysis can be continued (for example, repair, or exchange of consumables is necessary). In the event of such a failure, the red status indicator at the front of the module is switched on, and an entry is written into the module logbook.

If an error occurs outside a method run, other modules will not be informed about this error. If it occurs within a method run, all connected modules will get a notification, all LEDs get red and the run will be stopped. Depending on the module type, this stop is implemented differently. For example, for a pump the flow will be stopped for safety reasons. For a detector, the lamp will stay on in order to avoid equilibration time. Depending on the error type, the next run can only be started, if the error has been resolved, for example liquid from a leak has been dried. Errors for presumably single time events can be recovered by switching on the system in the user interface.

Special handling is done in case of a leak. As a leak is a potential safety issue and may have occurred at a different module from where it has been observed, a leak always causes a shutdown of all modules, even outside a method run.

In all cases, error propagation is done via the CAN bus or via an APG remote cable (see documentation for the APG interface).

General Error Messages

General error messages are generic to all Agilent series HPLC modules and may show up on other modules as well.

Timeout

Error ID: 0062

The timeout threshold was exceeded.

Probable cause	Suggested actions
1 The analysis was completed successfully, and the timeout function switched off the module as requested.	Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.
2 A not-ready condition was present during a sequence or multiple-injection run for a period longer than the timeout threshold.	Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.

Shutdown

Error ID: 0063

An external instrument has generated a shutdown signal on the remote line.

The module continually monitors the remote input connectors for status signals. A LOW signal input on pin 4 of the remote connector generates the error message.

Probable cause	Suggested actions
1 Leak detected in another module with a CAN connection to the system.	Fix the leak in the external instrument before restarting the module.
2 Leak detected in an external instrument with a remote connection to the system.	Fix the leak in the external instrument before restarting the module.
3 Shut-down in an external instrument with a remote connection to the system.	Check external instruments for a shut-down condition.

Remote Timeout

Error ID: 0070

A not-ready condition is still present on the remote input. When an analysis is started, the system expects all not-ready conditions (for example, a not-ready condition during detector balance) to switch to run conditions within one minute of starting the analysis. If a not-ready condition is still present on the remote line after one minute the error message is generated.

Probable cause	Suggested actions
1 Not-ready condition in one of the instruments connected to the remote line.	Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.
2 Defective remote cable.	Exchange the remote cable.
3 Defective components in the instrument showing the not-ready condition.	Check the instrument for defects (refer to the instrument's documentation).

Lost CAN Partner

Error ID: 0071

During an analysis, the internal synchronization or communication between one or more of the modules in the system has failed.

The system processors continually monitor the system configuration. If one or more of the modules is no longer recognized as being connected to the system, the error message is generated.

Probable cause	Suggested actions
1 CAN cable disconnected.	• Ensure all the CAN cables are connected correctly. • Ensure all CAN cables are installed correctly.
2 Defective CAN cable.	Exchange the CAN cable.
3 Defective main board in another module.	Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.

Leak Sensor Short

Error ID: 0082

The leak sensor in the module has failed (short circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak sensor current to change within defined limits. If the current increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Defective leak sensor.	Please contact your Agilent service representative.
2 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.

Leak Sensor Open

Error ID: 0083

The leak sensor in the module has failed (open circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak-sensor current to change within defined limits. If the current falls outside the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Leak sensor not connected to the Power Switch board.	Please contact your Agilent service representative.
2 Defective leak sensor.	Please contact your Agilent service representative.
3 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.

Compensation Sensor Open

Error ID: 0081

The ambient-compensation sensor (NTC) on the power switch board in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the power switch board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Loose connection between the power switch board and the main board	Please contact your Agilent service representative.
2 Defective power switch board	Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

The ambient-compensation sensor (NTC) on the power switch board in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the power switch board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor falls below the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Defective power switch board	Please contact your Agilent service representative.
2 Loose connection between the power switch board and the main board	Please contact your Agilent service representative.

Fan Failed

Error ID: 0068

The cooling fan in the module has failed.

The hall sensor on the fan shaft is used by the main board to monitor the fan speed. If the fan speed falls below a certain limit for a certain length of time, the error message is generated.

Depending on the module, assemblies (e.g. the lamp in the detector) are turned off to assure that the module does not overheat inside.

Probable cause	Suggested actions
1 Fan cable disconnected.	Please contact your Agilent service representative.
2 Defective fan.	Please contact your Agilent service representative.
3 Defective main board.	Please contact your Agilent service representative.

Leak

Error ID: 0064

A leak was detected in the module.

The signals from the two temperature sensors (leak sensor and board-mounted temperature-compensation sensor) are used by the leak algorithm to determine whether a leak is present. When a leak occurs, the leak sensor is cooled by the solvent. This changes the resistance of the leak sensor which is sensed by the leak-sensor circuit on the main board.

Probable cause	Suggested actions
1 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.

Pump Error Messages

These errors are pump specific.

Pressure of quaternary pump above upper limit

Error ID: 29163

The pressure has exceeded the upper pressure limit.

- Parameter: Measured pressure

Probable cause	Suggested actions
1 Blockage in flow path after the pressure sensor.	• Check for blockages in the LC system, e.g. purge valve, Jet Weaver, degraded column, column frits, needle, needle seat, capillaries etc. • Check for particles in the solvent.
2 Inappropriate settings (pressure limit, flow rate).	• Decrease flow rate. • Increase pressure limit.

Pressure below lower limit

Error ID: 29176

The pressure has dropped below the lower limit.

- Parameter: None

Probable cause	Suggested actions
1 Leak	Check for leaks.
2 Bottle empty	Check bottle filling.
3 Wrong solvent (viscosity)	Check solvent.
4 Inappropriate setting	Check flow rate and lower pressure limit.
5 Column degradation	Replace column.

Target pressure not reached for quaternary pump degasser

Error ID: 29221

The target pressure of the quaternary pump degasser has not been reached within the expected time.

- Parameter: Pressure in mbar

Probable cause	Suggested actions
1 Condensation in degasser chamber due to temperature fluctuation.	Equilibrate and restart module.
2 Degasser is defect.	Please contact your Agilent service representative.

Solvent counter exceeded limit

Error ID: 29146

The counter for the solvent volume has exceeded the limit, which has been set in the user interface.

Probable cause	Suggested actions
1 No solvent present.	Refill solvent bottle.
2 Inappropriate setting.	Check solvent counter setting in user interface.

Waste counter limit exceeded

Error ID: 29147

The counter for the waste volume has exceeded the limit, which has been set in the user interface.

- Parameter: None

Probable cause	Suggested actions
1 The waste container is full.	Empty waste container.
2 Inappropriate setting for waste counter.	• Reset waste counter. • Adjust waste counter limit.

Flow rate limit exceeded

Error ID: 29164

The flow rate of the quaternary pump has exceeded the limit, while the pump runs in pressure controlled mode, e.g. during a pressure test.

- Parameter: None

Probable cause	Suggested actions
1 Leak	Check for leaks in the pump and flow path.
2 Bottle empty.	Fill solvent bottle.
3 Shutoff valve closed (if applicable).	Open shutoff valve.
4 Drift of pressure sensor (unlikely for short tests taking some minutes).	Replace pressure sensor.

Quaternary pump shutdown during analysis

Error ID: 29199

The quaternary pump has been shut down by the control software or control module during an analysis.

- Parameter: 0 for off, 1 for standby.

Probable cause	Suggested actions
1 Pump has been shut down.	Restart pump.

Reading the pump encoder tag failed

Error ID: 29201

Reading the pump encoder tag has failed.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Defect connection between encoder and main board.	Please contact your Agilent service representative.
2 Missing or defect tag Defect connection between tag and encoder.	Please contact your Agilent service representative.

Writing the pump encoder tag failed

Error ID: 29200

Writing the pump encoder tag has failed.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Defect connection between encoder and main board.	Please contact your Agilent service representative.
2 Defect tag Defect connection between tag and encoder.	Please contact your Agilent service representative.

Pump drive blocked or encoder failed

Error ID: 29214

Pump drive blocked or encoder failed.

- Parameter: None

Probable cause	Suggested actions
1 Blockage of the pump drive Drive encoder failed.	Please contact your Agilent service representative.

Drive current too low

Error ID: 29205

The current consumption of the pump drive is too low.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Drive motor defect.	Please contact your Agilent service representative.
2 Wrong/missing connection of pump drive to main board.	Please contact your Agilent service representative.

Drive current too high

Error ID: 29236

The current consumption of the pump drive is too high.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Blockage of system before pressure sensor.	Check for blockage of e.g. outlet valve filter frit, Multi Purpose Valve, heat exchanger.
2 Drive motor defect.	Please contact your Agilent service representative.

Drive timeout

Error ID: 29204

Movement of drive during initialization is blocked mechanically.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Blockage in flow path	Remove capillary connection to system, check outlet filter, check valves, check pump head.
2 Blockage of pump drive Drive motor defect.	Please contact your Agilent service representative.

Overcurrent of pump drive

Error ID: 29202

The current consumption of the pump drive is too high.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Blockage of system before pressure sensor.	Check for blockage of e.g. outlet valve filter frit, Multi Purpose Valve, heat exchanger.
2 Drive motor defect.	Please contact your Agilent service representative.

Deliver underrun

Error ID: 29233

Internal error.

- Parameter: None

Probable cause	Suggested actions
1 Internal error.	Please contact your Agilent service representative.
2 Firmware issue	Use a minimum firmware revision of B.06.55

Defect connection between main board and pump drive encoder

Error ID: 29208

Defect connection between main board and pump drive encoder.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Defect connection between main board and pump drive encoder.	Please contact your Agilent service representative.
2 Defect encoder.	Please contact your Agilent service representative.

Pump drive encoder defect

Error ID: 29209

Defect pump drive encoder.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Defect encoder.	Please contact your Agilent service representative.

Multi Purpose Valve failed

Error ID: 29231

Lost steps of the purge valve encoder.

- Parameter: None

Probable cause	Suggested actions
1 Multi purpose valve drive mechanically blocked or defect.	• Check installation of multi purpose valve head. • Replace multi purpose valve head.

Reading of multi purpose valve tag failed

Error ID: 29240

Reading the multi purpose valve tag failed.

- Parameter: None

Probable cause	Suggested actions
1 Reading of multi purpose valve tag failed.	Check cable connection.
2 Multi purpose valve head tag defect or empty.	Replace multi purpose valve head.
3 Multi purpose valve tag reader is defect.	Please contact your Agilent service representative.

Pump drive encoder rollover

Error ID: 29232

Invalid pump drive encoder signals have been detected.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Drive position limit

Error ID: 29234

Internal error.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Internal error.	Please contact your Agilent service representative.

Insufficient power of drive encoder LED

Error ID: 29235

Insufficient power of drive encoder LED.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Drive encoder error

Error ID: 29237, 29238, 29239, 29215

An error has occurred for the pump drive encoder.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Writing the multi purpose valve tag failed

Error ID: 29241

Writing the multi purpose valve tag failed.

- Parameter: None

Probable cause	Suggested actions
1 Multi purpose valve head tag defect.	Replace multi purpose valve head.
2 Multi purpose valve tag head reader is defect.	Please contact your Agilent service representative.

Unknown multi purpose valve type

Error ID: 29242

The type information of the multi purpose valve is invalid.

- Parameter: None

Probable cause	Suggested actions
1 Wrong valve head installed.	Check or replace multi purpose valve head.
2 Valve head has invalid RFID tag content.	Check or replace multi purpose valve head.

Pump drive encoder error

Error ID: 29211

The pump drive encoder has generated no signal.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Pump drive error

Error ID: 29212, 29213

The pump drive failed during calibration.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Maximum stroke is too short

Error ID: 29203

The maximum stroke is too short.

During initialization the pump defines the operation position of the pump drives and therefore the pistons. First the pump drive moves backwards to find a mechanical stop within the ball screw. Afterwards, pistons move forwards for finding the maximum available stroke volume. These values are expected within a pre-defined range. "Maximum stroke too short" means that the outer drive position is too close. This can be caused by a drive initialization without pump head or if the pump head has not been installed properly (screws are loose).

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Wiper shifted	Please contact your Agilent service representative.
2 Pump head blocks piston movement	Replace, clean or repair pump head.
3 Pump drive motor is mechanically blocked.	Please contact your Agilent service representative.

Pump drive stop not found

Error ID: 29207

The pump drive stop has not been found.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Pump drive spindle is defect.	Please contact your Agilent service representative.

Timeout: Wait for Composition

Error ID: 29180

A target condition (composition) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly.

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

Timeout: Wait for run volume

Error ID: 29181

A target condition (run volume, which is the volume delivered since the method run start) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly (for example the flow rate).

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

Timeout: Wait for Volume

Error ID: 29182

A target condition (volume, which is the delivered flow since the limit has been set) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly (for example the flow rate).

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

Timeout: Wait for Flow

Error ID: 29183

A target condition (flow rate) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly.

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

Timeout: Wait for Pressure

Error ID: 29185

A target condition (pressure) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly.

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.
2 Leak	Run system pressure test for identifying and localizing the leak. Tighten leak.

Drive Encoder failed

Error ID: 29210

Drive encoder failed during pump drive calibration.

Probable cause	Suggested actions
1 Internal error.	Contact Agilent support.

Drive phases differ too much in electric resistance

Error ID: 29216

Pump drive calibration has failed due to a strong difference electric resistances for different motor phases.

Probable cause	Suggested actions
1 Pump drive cable defect.	Please contact your Agilent service representative.
2 Pump drive defect.	Please contact your Agilent service representative.
3 Defective main board.	Please contact your Agilent service representative.

Degasser's pressure limit violation

Error ID: 29220

Pressure too far above the limit.

Probable cause	Suggested actions
1 Leak in degasser chamber or degasser tubing.	Please contact your Agilent service representative.
2 Defect vacuum pump.	Please contact your Agilent service representative.
3 Degasser chamber empty or connected to air.	Block unused degasser channels.

Seal wash pump was missing when tried to turn on

Error ID: 29223

The seal wash pump has not been detected (while being configured or detected before)

Probable cause	Suggested actions
1 Defect cable connection to seal wash pump.	Check cable connection.
2 Defect seal wash pump motor.	Please contact your Agilent service representative.
3 Defective main board.	Please contact your Agilent service representative.

Valve hardware overcurrent (MCGV)

Error ID: 29227

Power consumption too high for one of the MCGV valves.

Probable cause	Suggested actions
1 Cable defect.	Replace MCGV.
2 Valve defect	Replace MCGV.
3 Defective main board.	Please contact your Agilent service representative.

7 Maintenance

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This chapter describes the maintenance of the Agilent 1290 Infinity II Flexible Pump.

Introduction to Maintenance

Figure 10 on page 81 shows the main user-accessible assemblies of the Agilent 1290 Infinity II Flexible Pump. These parts can be accessed from the front (simple repairs) and don't require to remove the pump from the system stack.

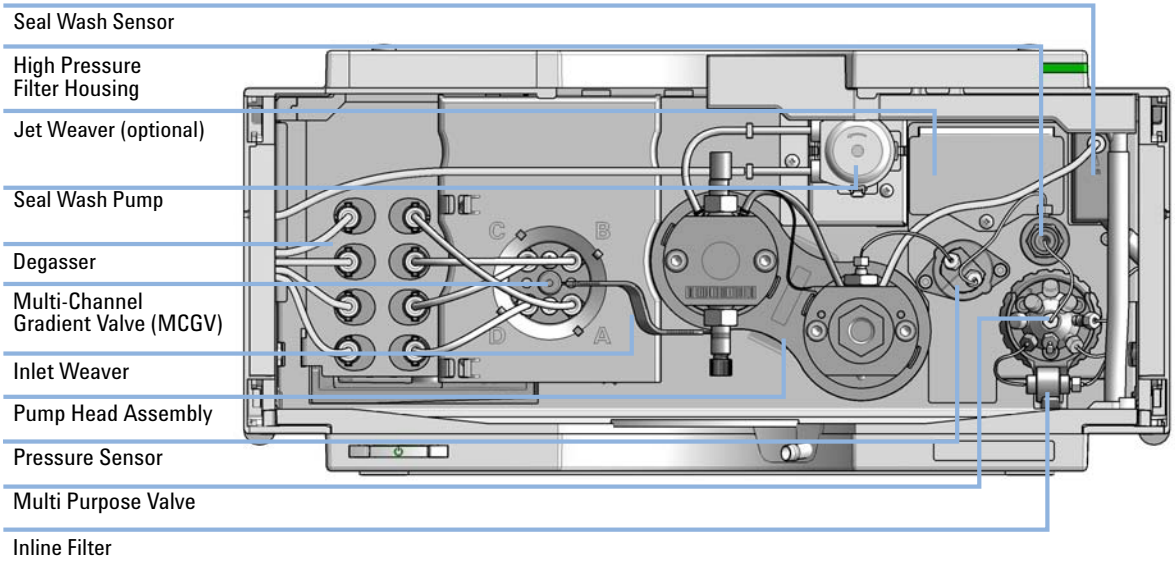


Figure 10 Overview of maintenance parts

Recommended Interval for Preventive Maintenance

The recommended interval for preventive maintenance is:

- 100 L or 1 year (whichever comes first).

This recommendation is valid for LC instruments on which "typical" applications are running.

A "typical" application can be characterized as follows:

- pressure range 100 – 800 bar,
- flow rates 0.5 – 3.5 mL/min,
- typical solvents used in reversed phase LC.

Warnings and Cautions

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

- ➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
- ➔ The volume of substances should be reduced to the minimum required for the analysis.
- ➔ Do not operate the instrument in an explosive atmosphere.

WARNING

Electrical shock

Repair work at the module can lead to personal injuries, e.g. shock hazard, when the cover is opened.

- ➔ Do not remove the cover of the module.
- ➔ Only certified persons are authorized to carry out repairs inside the module.

WARNING

Personal injury or damage to the product

Agilent is not responsible for any damages caused, in whole or in part, by improper use of the products, unauthorized alterations, adjustments or modifications to the products, failure to comply with procedures in Agilent product user guides, or use of the products in violation of applicable laws, rules or regulations.

- ➔ Use your Agilent products only in the manner described in the Agilent product user guides.

CAUTION

Safety standards for external equipment

➔ If you connect external equipment to the instrument, make sure that you only use accessory units tested and approved according to the safety standards appropriate for the type of external equipment.

Overview of Maintenance

The following pages describe maintenance (simple repairs) of the module that can be carried out without opening the main cover.

Cleaning the Module

To keep the module case clean, use a soft cloth slightly dampened with water, or a solution of water and mild detergent.

WARNING **Liquid dripping into the electronic compartment of your module can cause shock hazard and damage the module**

➔ Do not use an excessively damp cloth during cleaning.

➔ Drain all solvent lines before opening any connections in the flow path.

Install Fittings and Capillaries

WARNING

Solvent can spray under high pressure.

➔ Observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing), when opening flow path.

CAUTION

Deformation of fittings and seals

Liquid drops under high pressure up to 1200 bar act like solid parts. Tightening connections under high pressure can deform or destroy fittings and seals.

➔ Never tighten flow connections under pressure.

NOTE

The lifetime of a fitting depends on how firmly it has been tightened; firm tightening reduces the lifetime.

If fitting has been overtightened, replace it.

1 Install fittings and capillaries.

2 Tighten fittings and capillaries.

Remove and Install Doors

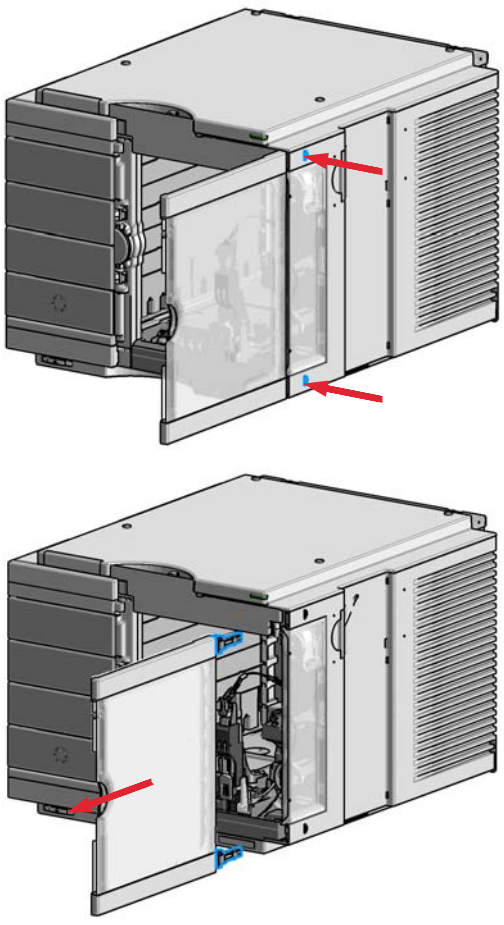
Parts required	p/n	Description
	5067-5745	Door Assy Infinity 180 Left
	5067-5746	Door Assembly Infinity 180 Right

NOTE

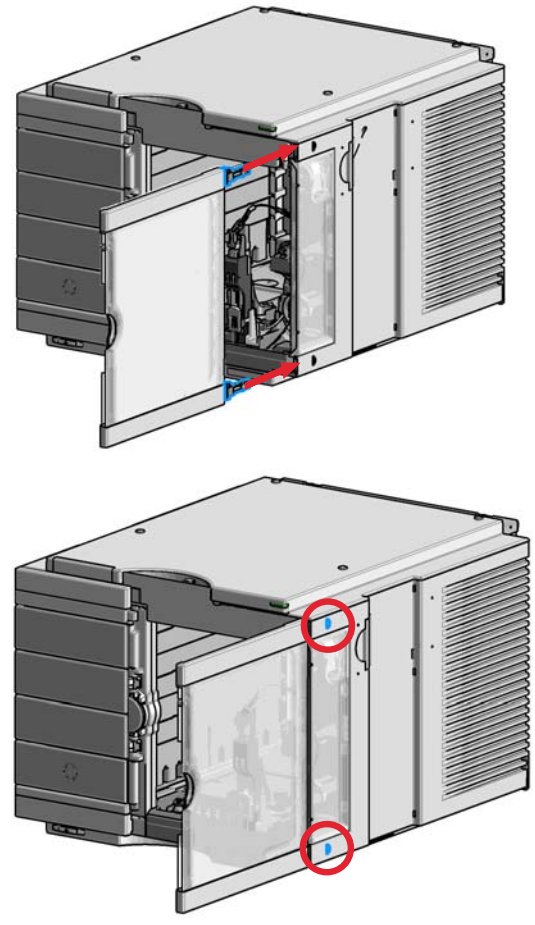
The figures shown in this procedure exemplarily show the Infinity II Multisampler module.

The principle of how to remove and/or install doors works in the same way for all Infinity II modules.

1 Press the release buttons and pull the front door out.



2 For the Installation of the front door. Insert the hinges into their guides and move the door in until the release buttons click into their final position.



Replace the Pressure Sensor

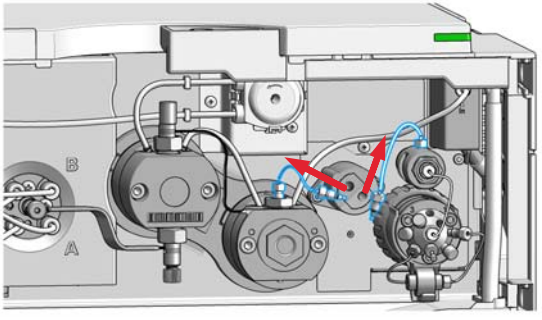
When	No or invalid pressure signal	
Tools required	**p/n**	**Description**
	8710-2412	Hex key 2.5 mm, 15 cm long, straight handle
	8710-0510	Wrench open 1/4 — 5/16 inch
		Screwdriver
Parts required	**p/n**	**Description**
	G7104-60001	Pressure sensor 1300 bar
Preparations	Turn off pump flow, switch off pump	

NOTE This procedure describes how to replace the pressure sensor.

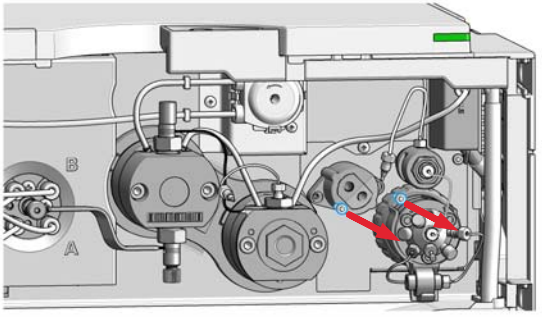
In case the cable to the sensor shall be replaced as well, please contact your Agilent service representative.

NOTE Working on connections to the pressure sensor may slightly change the displayed pressure. In case of a pressure offset at ambient pressure, a pressure offset calibration may be run.

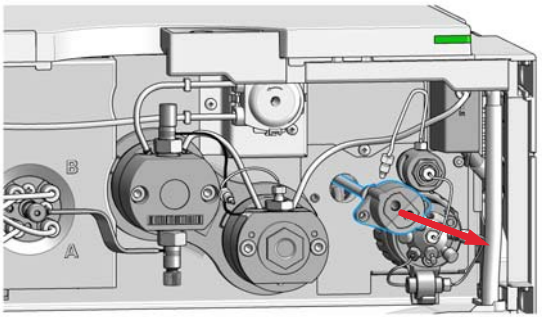
1 Remove capillary connections between the pressure sensor and the High Pressure Filter, and between the pressure sensor and the outlet filter of the secondary pump head, respectively.



2 Remove the screws that fix the pressure sensor to the chassis.

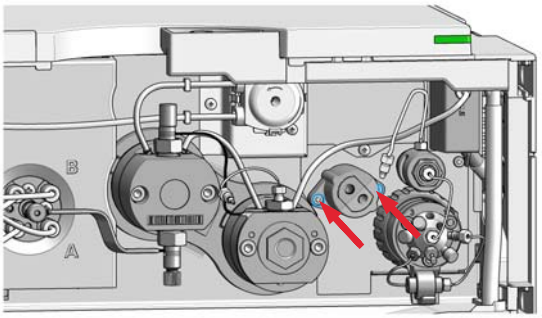


3 Carefully pull out the pressure sensor for about 2 cm. Then unscrew the cable from the pressure sensor.

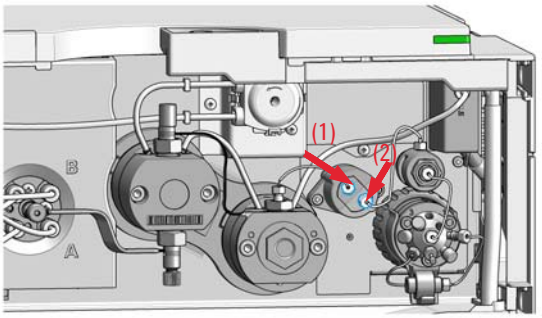


4 Connect the new pressure sensor to the pressure sensor connector.

5 Fix the pressure sensor to the instrument chassis.



6 Connect the capillary from the pump head outlet to the pressure sensor inlet (1). Connect the capillary from the high pressure filter to the pressure sensor outlet (2). Two arrow signs on the pressure sensor indicate the flow direction.



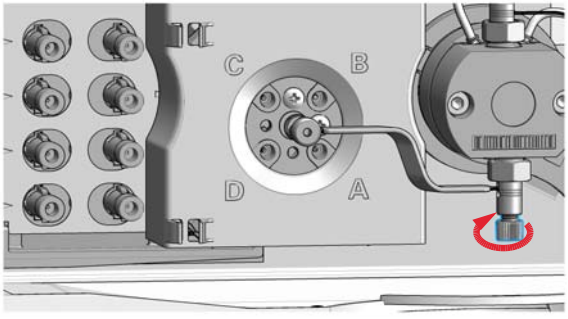
Replace the Inlet Weaver

Parts required	p/n	Description
	G4204-81090	1290 Infinity Quaternary Pump Inlet Weaver Assembly

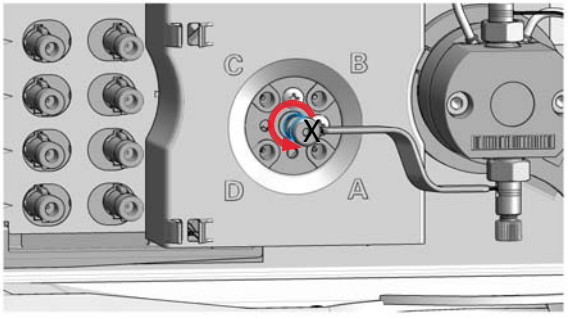
Preparations

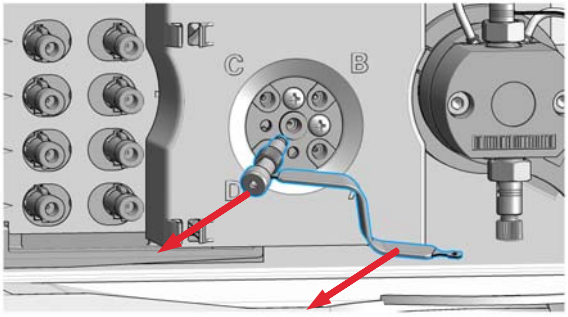
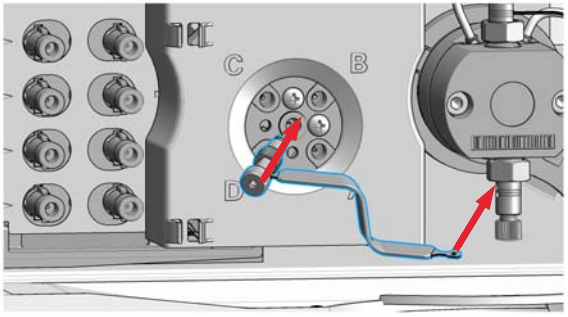
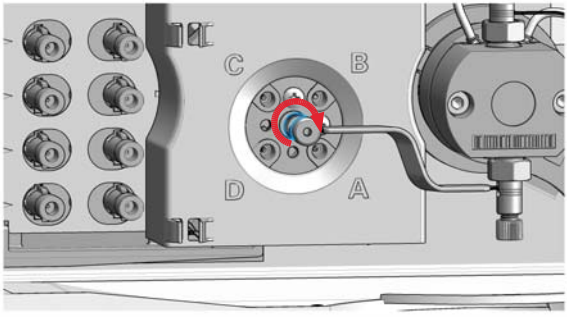
- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
- For easy access to the inlet weaver assembly, remove tubing connections between MCGV and degasser

1 Open the screw at the bottom of the inlet valve.



2 Open the fitting at the center of the multi-channel gradient valve (MCGV). Do not open the screw marked with the black cross. Remove the inlet weaver from the MCGV.



3 Pull the Inlet Weaver out of the Inlet Valve. 	**4** Insert the new inlet weaver to the inlet valve. Fix the weaver with the plastic screw. 
5 Fix the fitting of the new inlet weaver to the MCGV. 	**6** Reconnect tubings between MCGV and degasser.

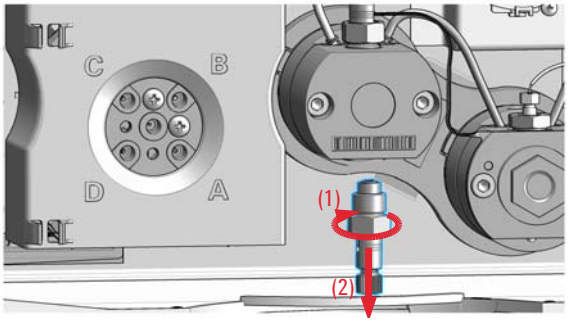
Replace the Inlet Valve

When	If Inlet valve is defective.	
Tools required	**p/n**	**Description**
		Wrench, 14 mm
	G4220-20012	Torque wrench 2 – 25 Nm
Parts required	**p/n**	**Description**
	G4204-60022	Inlet Valve 1290 Infinity Quaternary Pump

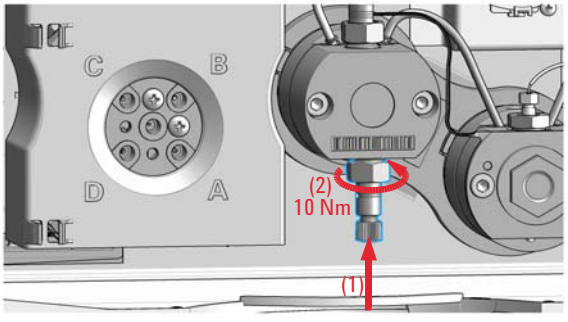
Preparations

- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
- Remove the inlet weaver, see "Replace the Inlet Weaver" on page 90

1 With a 14 mm wrench, unscrew the inlet valve and remove it.



2 Install the new inlet valve and tighten it using a torque wrench with a 14 mm bit set to 10 Nm.



Next Steps:

3 Insert the inlet weaver, see "Replace the Inlet Weaver" on page 90.

4 Purge the system to remove air.

Replace the Outlet Valve

When If Outlet valve is defective.

Tools required

p/n	Description
	Wrench, 14 mm
G4220-20012	Torque wrench 2 – 25 Nm
G4220-20041	Bit Torx 10x25 mm

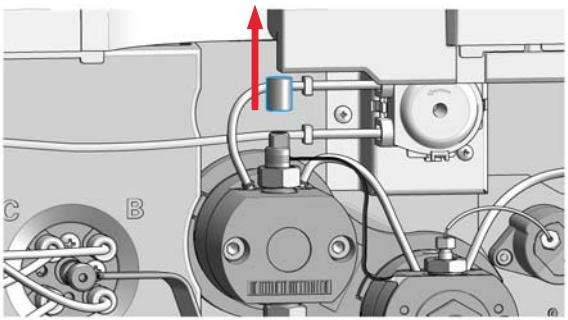
Parts required

p/n	Description
G4220-60028	Outlet valve (primary pump head)
G4220-20020	Internal gold seal for Outlet Valve

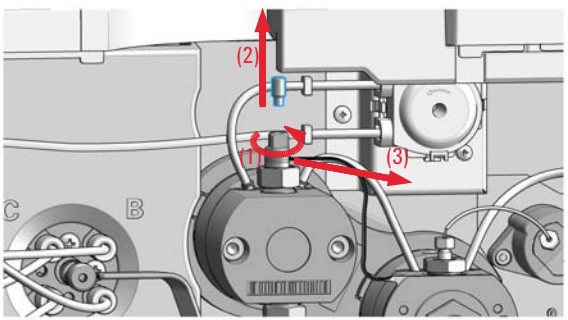
Preparations

- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages

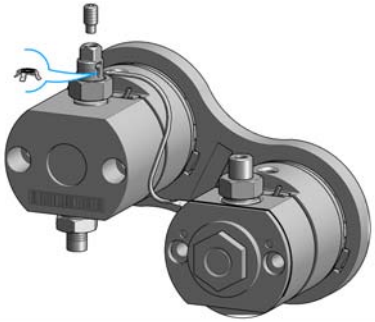
1 Remove the cap from the outlet valve.



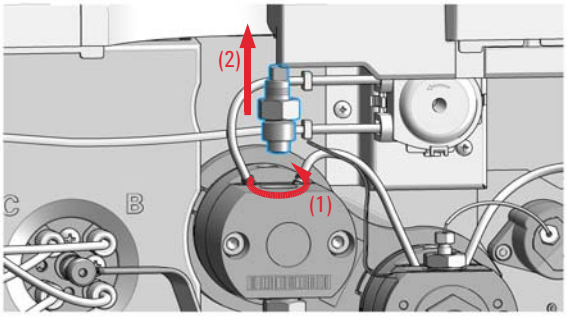
2 Open the 2.5 mm hex screw at the top of the primary pump head, which fixes the connection capillary of the heat exchanger (1) and remove it (2). Then lift up the capillary and remove it from the primary pump head (3).



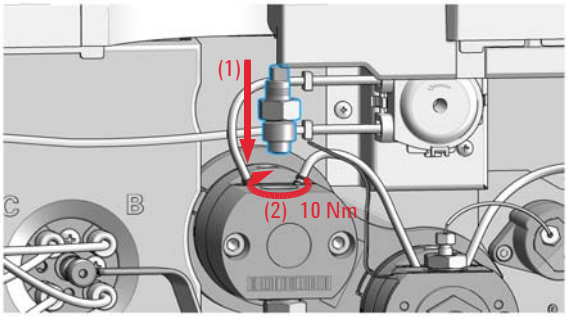
3 A gold seal between outlet valve and heat exchanger capillary is used for a tight connection. The seal can be replaced separately as needed.



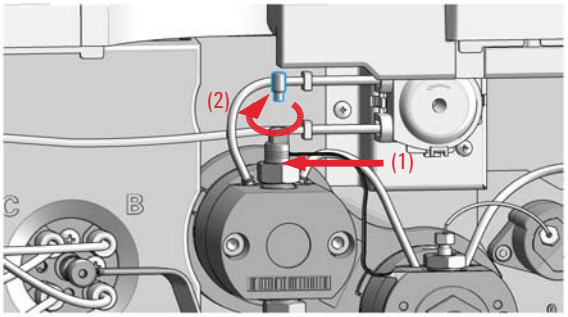
4 Unscrew the outlet valve with a 14 mm wrench (1) and remove it (2).



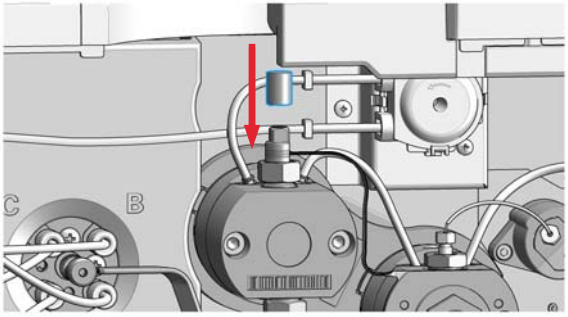
5 Insert the new outlet valve and tighten it using a torque wrench with a 14 mm bit set to 10 Nm.



6 Insert the heat exchanger capillary into the outlet of the outlet valve (1). Using a torque wrench with a 2.5 mm hex bit, set 3 Nm and close the hex screw at the top of the outlet (2).



7 Replace the cap of the Outlet Valve.



8 Purge the system to remove air.

Remove the Jet Weaver

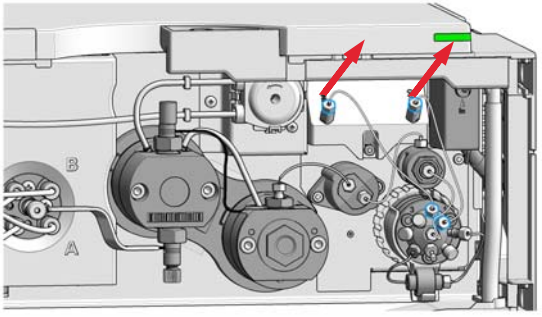
Tools required	p/n	Description
	8710-0510	Wrench open 1/4 — 5/16 inch
	8710-0899	Pozidriv screwdriver

Parts required	#	p/n	Description
	2	0100-1259	Plastic fittings

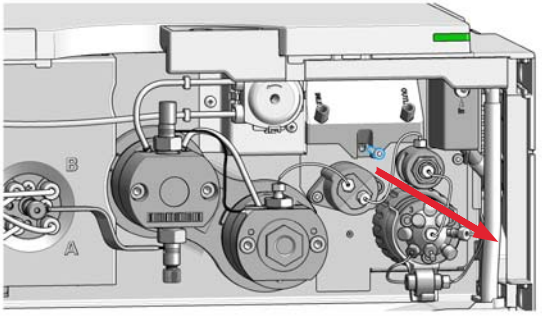
Preparations

- Select **Do not use mixer** in ChemStation.
- Switch off the pump at the main power switch.

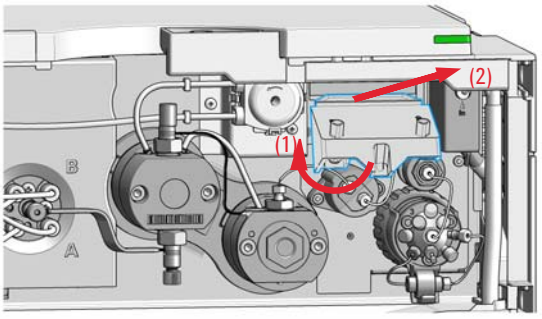
1 Remove capillary connections from the Jet Weaver to the Multi Purpose Valve.



2 Open the screw which fixes the Jet Weaver to the front panel.



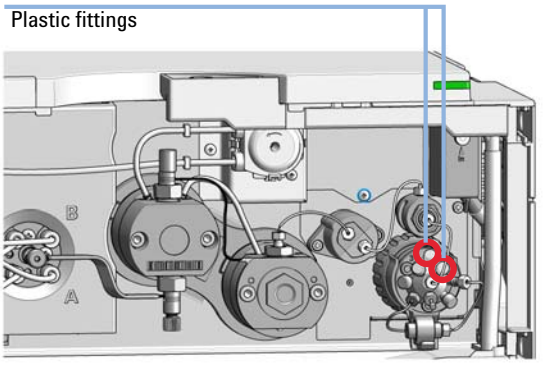
3 Lift up the Jet Weaver (1) and pull it out of the front panel (2).



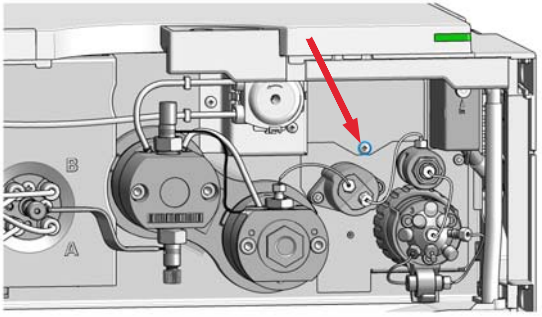
4 If no other Jet Weaver shall be installed, use plastic fittings for closing unused ports of the valve and install the metal lid.

OR

Otherwise continue at "Install the Jet Weaver" on page 97.



5 Fix the metal lid to the instrument chassis with a screw.



Install the Jet Weaver

When

The optional Jet Weaver 380 µL for 1290 Infinity Quaternary Pump (G4204-68000) is available for applications which require highest mixing performance, see chapter *Optimizing Performance*.

Tools required

Description
Screwdriver Pozidriv #1

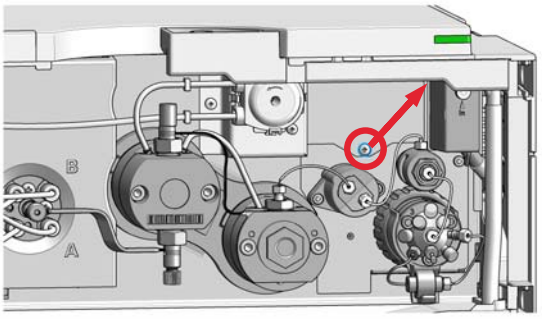
Parts required

#	p/n	Description
1	G4204-68000	Jet Weaver 380 µL for 1290 Infinity Quaternary Pump containing
2	5067-5416	Capillary ST 0.17 x 120 mm, SLV/SV Jet Weaver to Multi Purpose Valve

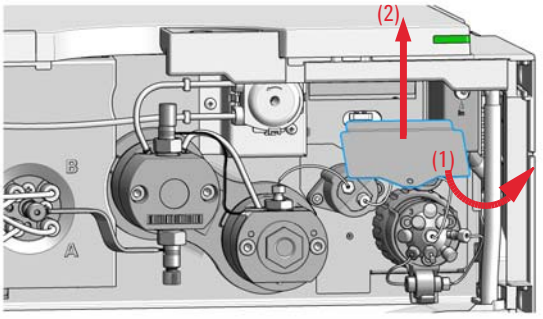
Preparations

Switch off the pump at the main power switch

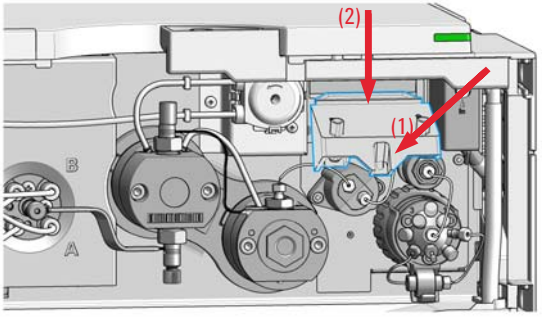
1 Open the screw of the Jet Weaver metal lid.



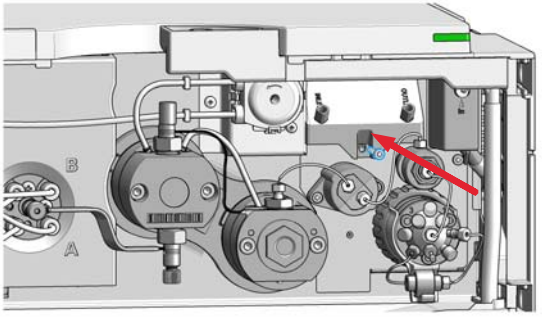
2 Remove the metal lid by lifting it up (1) and pulling it out of the front panel (2).



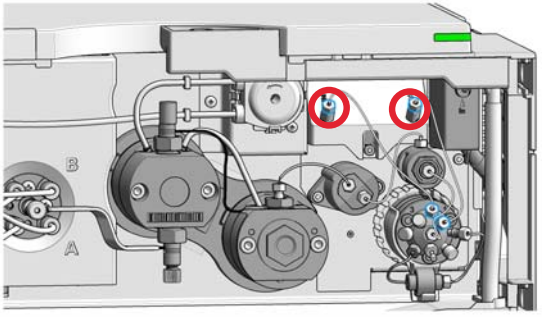
3 Insert the Jet Weaver to the opening in the front panel (1) and push it down (2).



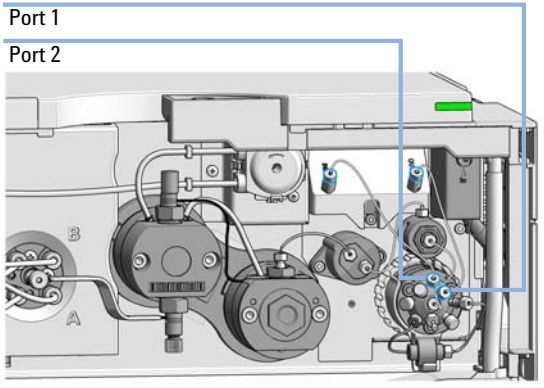
4 Fix the Jet Weaver with a screw.



5 Mount both capillary connections to the Jet Weaver observing the correct orientation.



6 Connect the inlet capillary of the Jet Weaver to port 2 of the Multi Purpose Valve. Connect the outlet capillary to port 1.

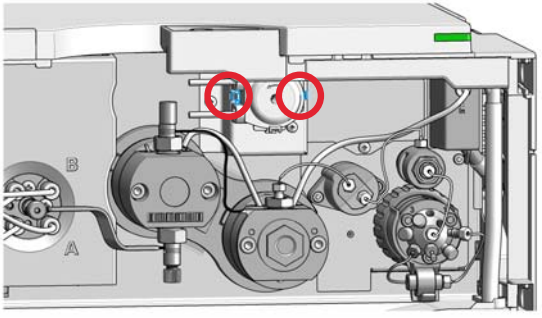


7 Configure the Jet Weaver as mixer in the user interface.

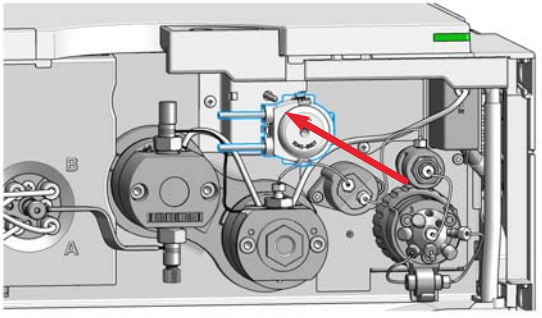
Replace the Seal Wash Pump

When	In case of wear of the seal wash pump	
Parts required	**p/n**	**Description**
	5065-4445	Peristaltic pump with Pharmed tubing
	5065-9978	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m
Preparations	Remove the flow connections from and to the seal wash pump.	

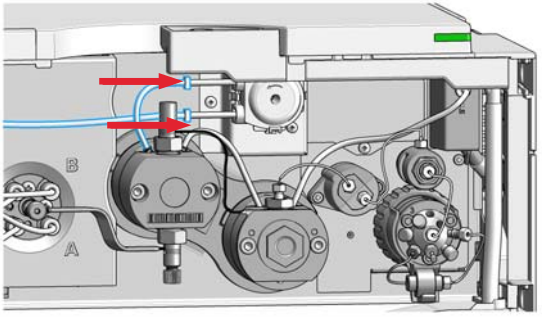
1 For removing the seal wash pump, press the clips (1) and pull the pump to the front (2).



2 Insert the pump clips to the holes in the module housing.



3 Fix the seal wash tubings to the peristaltic pump inlet (1) and the from the peristaltic pump outlet to the primary pump head inlet (2).



Replace the Multi-Channel Gradient Valve (MCGV)

Tools required	p/n	Description
	0100-1710	Mounting Tool for Tubing Connections
	8710-0899	Pozidriv screwdriver

Parts required	p/n	Description
	G1311-67701	Multi channel gradient valve (MCGV)

Preparations

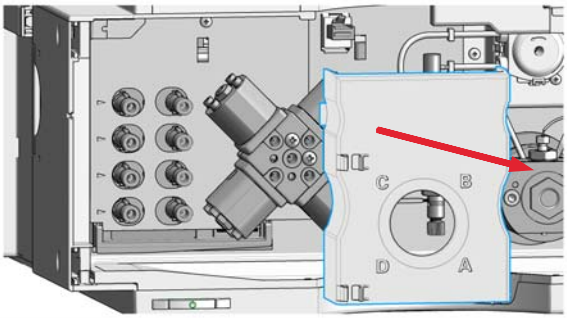
- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages

NOTE For best performance and life time, use lower channels A and D for aqueous solvents in buffer applications.

1 Use the mounting tool for removing tubing connections between the degassing unit and the MCGV.

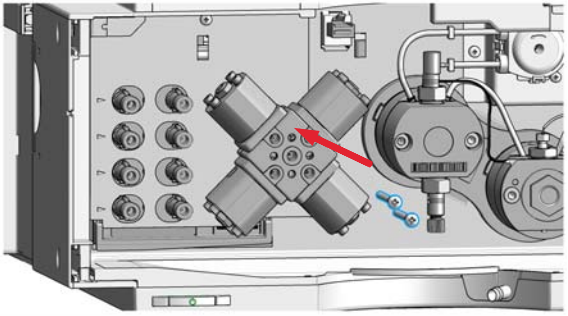
2 Remove the inlet weaver, see "Replace the Inlet Weaver" on page 90.

3 Remove the cover from the MCGV.



4 Disconnect the MCGV cable (1), unscrew the two screws (2, 3) and remove the valve.

5 Place the new MCGV into position.

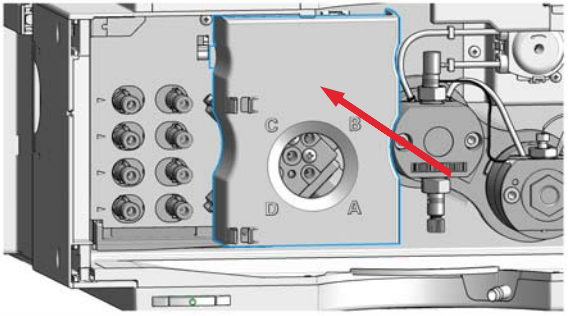


NOTE

Make sure that channel A of the MCGV is put at the bottom-right position.

6 Tighten the two screws (1, 2) and connect the cable to its connector (3).

7 Install the MCGV cover.



Next Steps:

8 Install the inlet weaver, see "Replace the Inlet Weaver" on page 90.

9 Reconnect solvent tubes for channels A-D from the MCGV to the degasser outlets.

Release a Stuck Inlet Valve

Tools required	p/n	Description
	9301-0411	Syringe, Plastic
	0100-1681	Syringe adapter luer/barb
	0100-1710	Mounting Tool for Tubing Connections
		Beaker

CAUTION

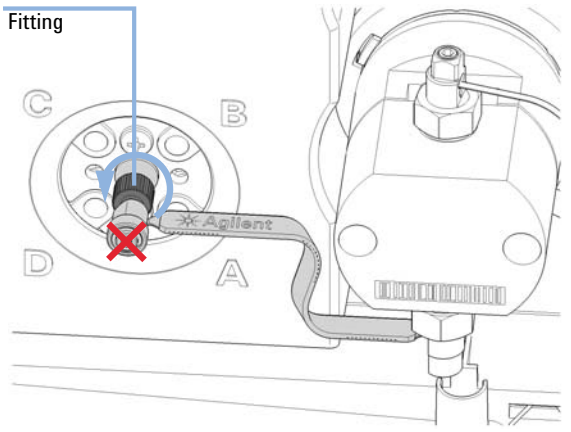
Pressure damages the multi-channel gradient valve (MCGV) and/or degasser

➔ Never apply pressure to the MCGV or degasser.

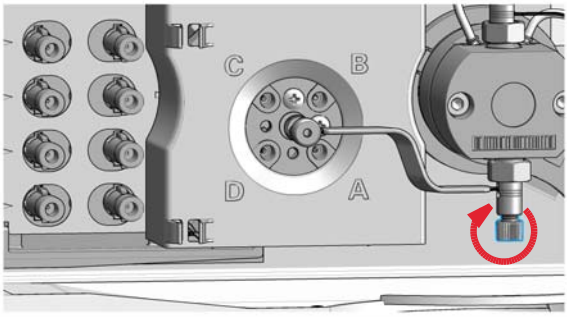
➔ Directly connect the syringe to the inlet weaver.

1 Remove tubing connections channels A, B, C and D to the MCGV such that you can access the inlet weaver.

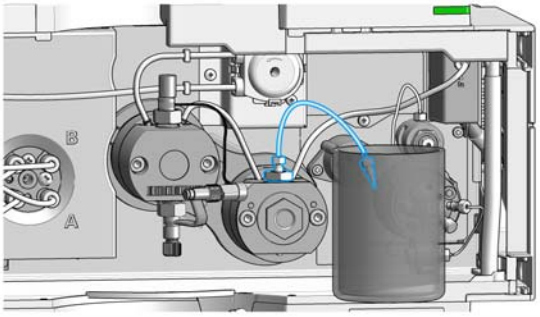
2 Open the fitting at the center of the multi-channel gradient valve (MCGV). Do not open the screw marked with the red cross. Remove the inlet weaver from the MCGV.



3 Slightly open the black plastic screw at the bottom of the inlet valve, and rotate the inlet weaver to the front. Then retighten the screw.



4 Disconnect the capillary from the pressure sensor inlet and route the capillary to a small beaker.

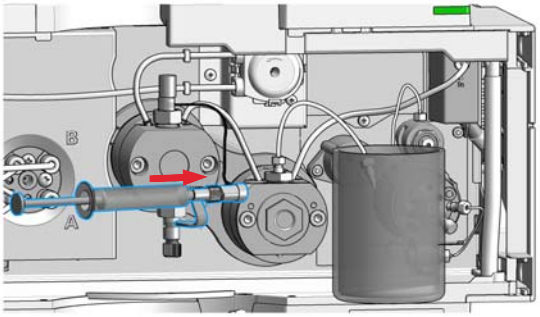


5 Fill the syringe with a suitable wash solvent.

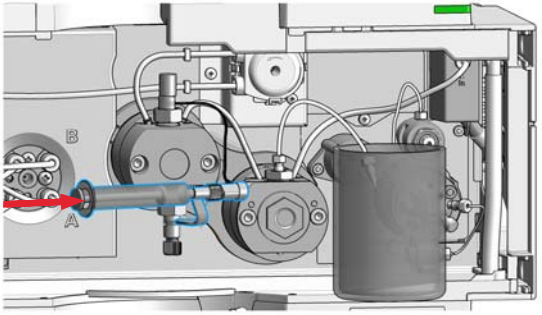
NOTE

For salt deposits, warm water is a good choice. For organic deposits, use ethanol or acetone.

6 Connect the syringe and adapter to the inlet weaver.



7 Push the syringe for flushing the inlet valve and pump head.



8 Restore original connections. Flush the system for several minutes.

Pump Head Procedures

CAUTION

Limitation of life time

The pump head assembly is an exchange part which cannot be reassembled with standard tools. Disassembling the pump head will strongly limit its life time.

➔ Do not disassemble the pump head assembly.

CAUTION

Damage of connections

Disassembling the flow connection between the two pump heads of the pump head assembly (solvent channel) can damage the connection and cause leaks.

➔ Do not disconnect the flow connection between the pump heads.

CAUTION

Damage of internal parts

➔ Do not apply a strong force to the screws of the pump head.

➔ Use a torque hex key for that purpose.

CAUTION

Damage of the pump piston

Removing pump heads in a position other than the maintenance position can damage the pump piston.

➔ Before switching off the pump, bring it to the maintenance position.

CAUTION

Damage of pump drives

The pump drive can be damaged if the pump initializes after switching it on without having the pump head installed properly.

➔ Use the Lab Advisor maintenance procedure for replacing pump heads.

➔ Install the pump head correctly before switching on the pump.

CAUTION

Damaged pump head

Disassembling or reassembling the pump head with tools other than the ones recommended can damage pump heads and significantly reduce their life time.

➔ Follow all instructions step by step.

➔ Use recommended tools like the pump head alignment tool and a torque wrench.

CAUTION

Damage of pump piston

The pump piston is made of ZrO_2-based ceramic, which is a very hard and resistant material, but it is sensitive to shearing forces from the side.

➔ Do not try to remove the pump piston from the rear.

➔ Do not use the piston for removing pump seals.

NOTE

Procedure is valid for primary and secondary pump head.

NOTE

You may assemble pump head parts only correctly. If parts are in wrong orientation, the screws do not fit in.

NOTE

Seals:

Always orientate the seals with the spring side towards the part.

Store seals in isopropanol and fit seals in wet.

HINT

Always ultrasonicate seals in solvent, to clean seals properly.

Obey the following order, to clean seals properly:

1 H_2O (tab)

2 H_2O (dest)

3 H_2O/Isopropanol 50%/50%

4 Isopropanol 100%

NOTE

If the pump head has been initialized without pump, this may have damaged the pump drive. In this case, please contact your local Agilent service organisation.

Remove the Pump Head Assembly

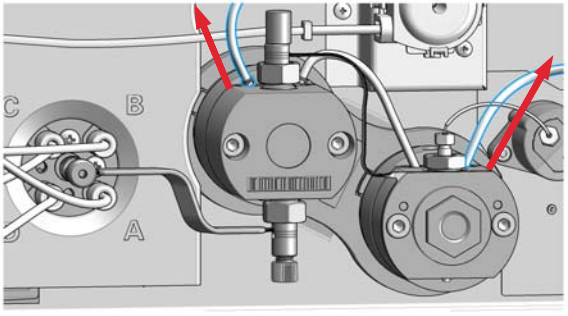
Tools required	p/n	Description
	G4220-20012	Torque wrench 2 – 25 Nm
	G4220-20013	4 mm hex bit
	G4220-20041	Bit Torx 10x25 mm
	8710-0510	Wrench open 1/4 — 5/16 inch

Preparations Remove the pump from the stack.

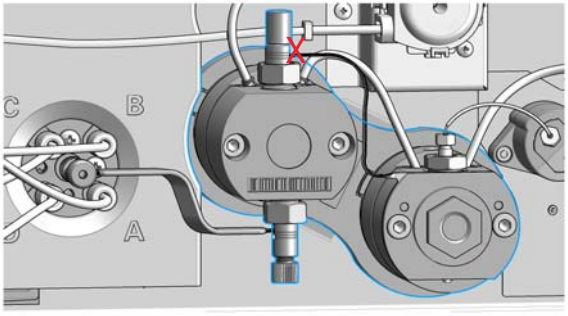
1 In Lab Advisor go to **Tools > Remove/Install Pump Head** and follow instructions given on the screen.

2 Open the doors

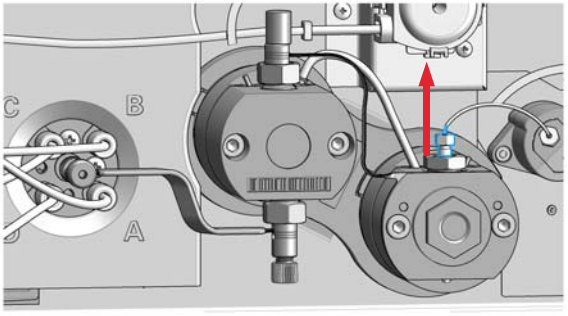
3 Remove the seal wash tubes.



4 DO NOT REMOVE the capillary connection between the pump heads marked by the red X.

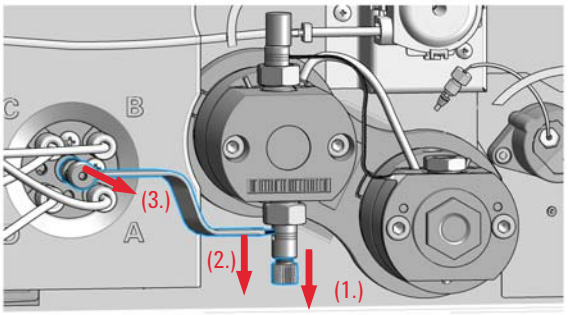


5 Remove the capillary connection from the outlet filter adapter on the secondary pump head to the pressure sensor.



6 Use the mounting tool for removing tubing connections between the degassing unit and the MCGV.

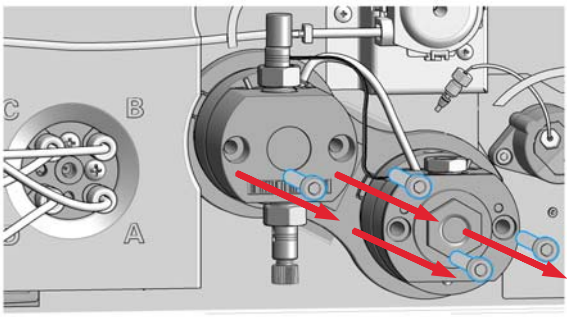
7 Open the black plastic screw of the inlet valve at the bottom of the left primary pump head (1) and remove the inlet weaver by first pushing it downwards (2) and then pulling it out to the left (3).



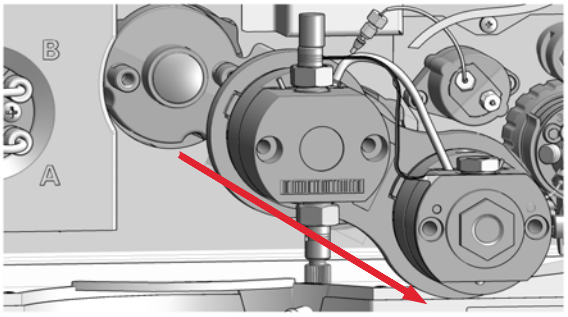
8 Open the four screws holding the pump heads.

NOTE

Open the screws step by step, not screw by screw.



9 Remove the complete pump head assembly by holding both heads and pulling it to the front.



10 Proceed to install (see "Install the Pump Head Assembly" on page 131) or disassemble the pump head (see "Disassemble the Pump Head Assembly" on page 108).

Disassemble the Pump Head Assembly

When If parts inside the pump head need to be replaced

Tools required

p/n	Description
G4220-20012	Torque wrench 2 – 25 Nm
G4220-20013	4 mm hex bit
G4220-20014	2.5 mm Hex Bit
G4220-20015	Adapter ¼ in square to hex
8710-0510	Wrench open 1/4 — 5/16 inch

Preparations Remove the pump head

CAUTION

Damaged pump head

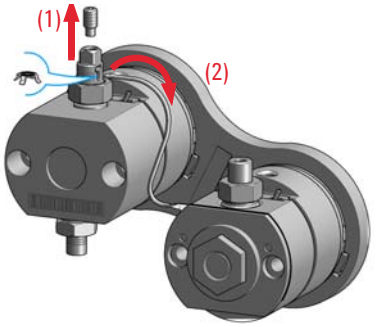
Disassembling or reassembling the pump head with tools other than the ones recommended can damage pump heads and significantly reduce their life time.

➔ Follow all instructions step by step.

➔ Use recommended tools like the pump head alignment tool and a torque wrench.

1 Place the pump head on a special holding tool.

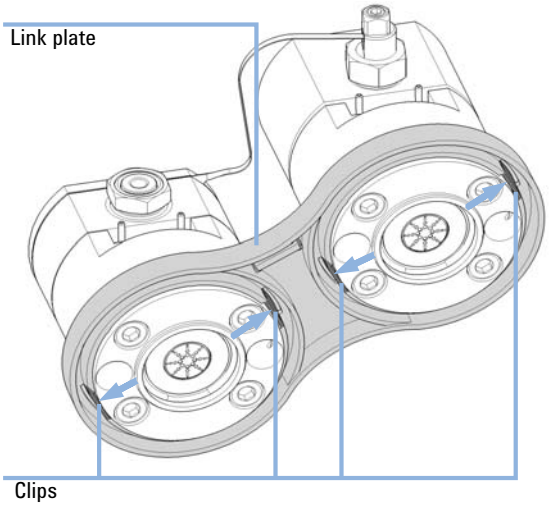
2 Open the 2.5 mm hex or Tx 10 screw at the top of the primary pump head, which fixes the connection capillary of the heat exchanger (1). Then lift up the capillary and remove it from the primary pump head (2).



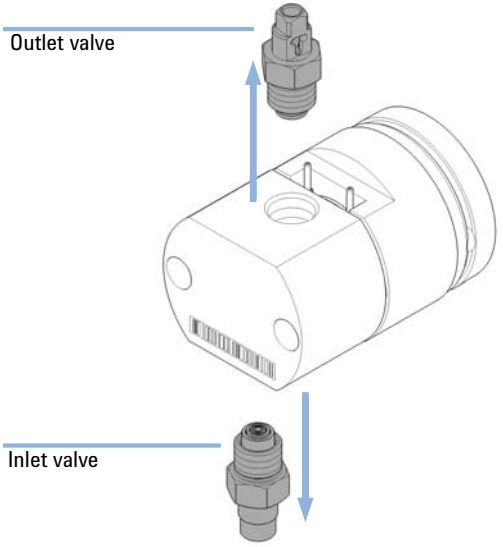
NOTE

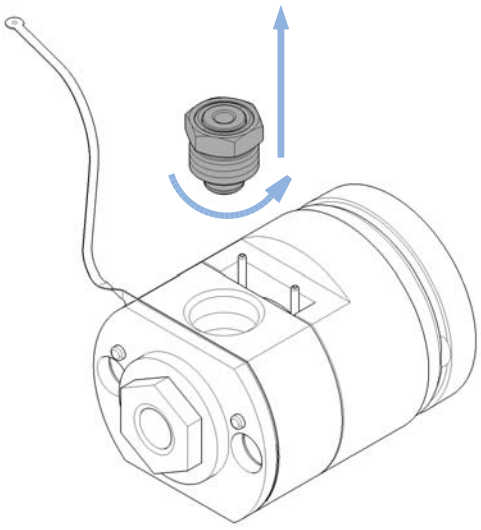
A gold seal between outlet valve and heat exchanger capillary is used for a tight connection.

3 Remove both pump heads from the link plate by pushing the clips at the rear of the plate.



4 Remove the outlet valve at the top of the pump head and the inlet valve at the bottom of the primary pump head.



5 Remove the outlet filter at the top of the secondary pump head. 	

Disassemble the Primary Pump Head

CAUTION

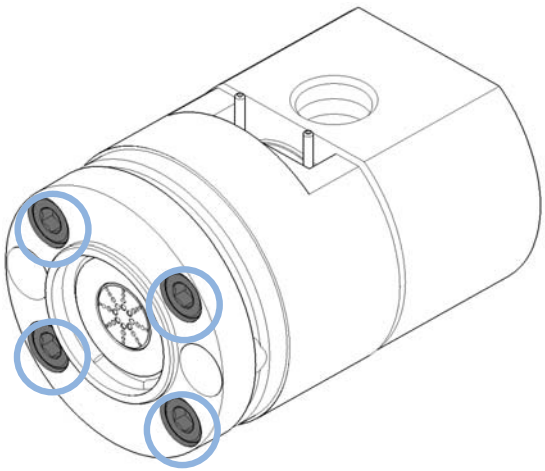
Damage of pump piston

The pump piston is made of ZrO_2-based ceramic, which is a very hard and resistant material, but it is sensitive to shearing forces from the side.

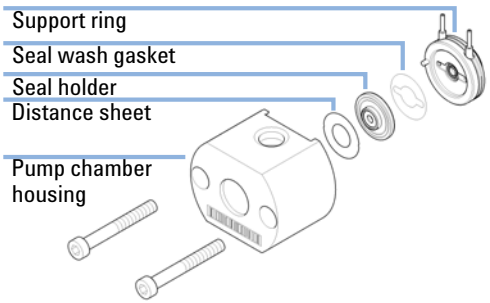
➔ Do not try to remove the pump piston from the rear.

➔ Do not use the piston for removing pump seals.

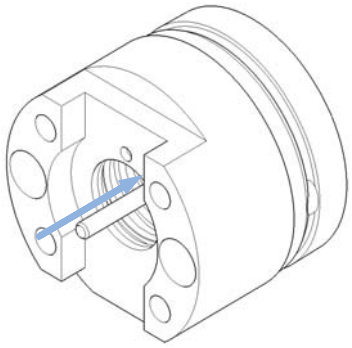
1 For disassembling the pump head, remove the 4 hex screws at the rear of the pump head.



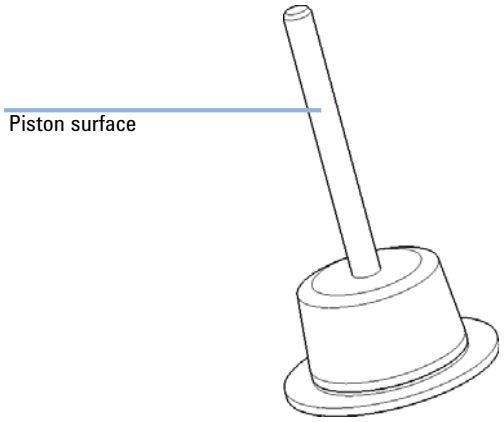
2 Remove the front part of the pump head including pump chamber housing with pump seal, distance sheet, support ring, seal holder including backup ring, and the gasket.



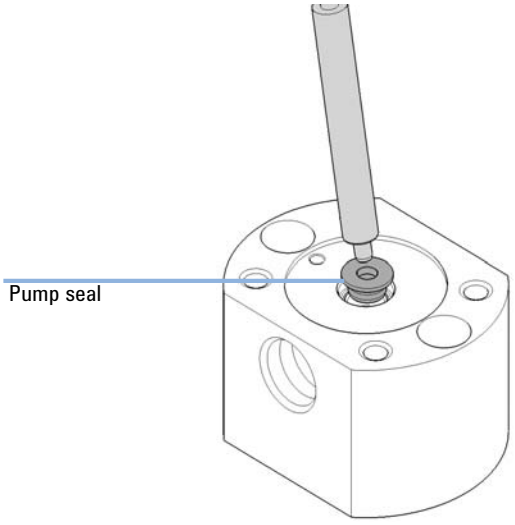
3 Remove the piston from the piston housing by pushing it to the rear, then pull it out from the rear.



4 Check the pump pistons for scratches grooves and dents



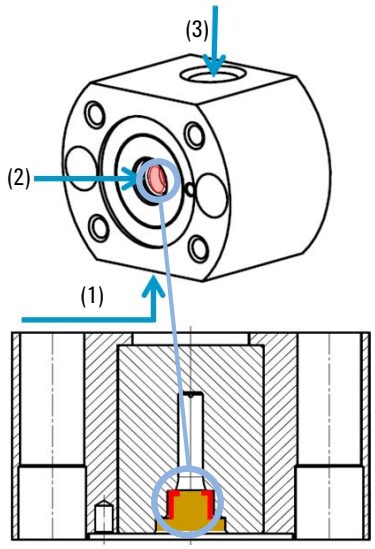
5 Use the steel side of the insert tool for removing the pump seal from the pump chamber housing.



NOTE

Do not use the pump piston for that purpose, as this can break it!

6 To flush out particles from the pump head, use pressurized air ((1), (2) and (3)).



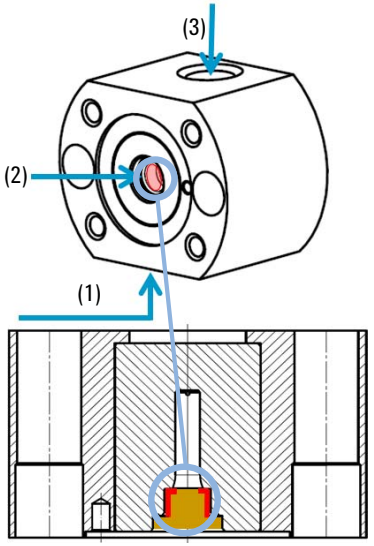
NOTE

Pump head parts in contact with the piston seal need to be cleaned properly in order to get a smooth surface and a tight connection.

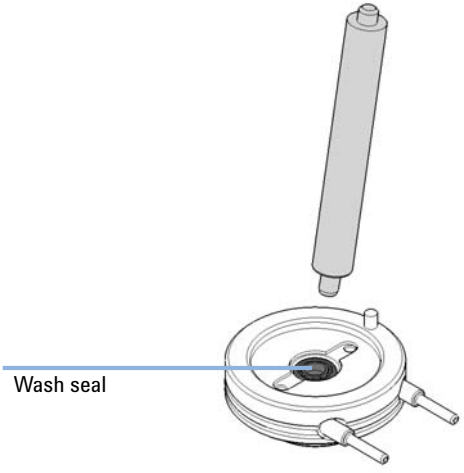
7 To remove wear, use isopropanol.

8 To clean the piston and the pump head sufrace, use the ultra fine abrasive mesh (p/n 8660-0852).

9 To dry the pump head and to remove residues, use pressurized air ((1), (2) and (3)).



10 If the wash seal shall be replaced by a new one, use the steel side of the insert tool for removing it.



Disassemble the Secondary Pump Head

CAUTION

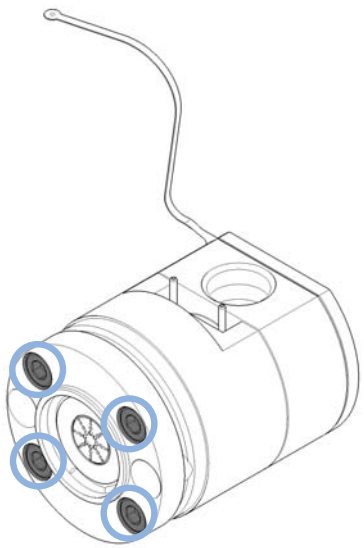
Damage of pump piston

The pump piston is made of ZrO_2-based ceramic, which is a very hard and resistant material, but it is sensitive to shearing forces from the side.

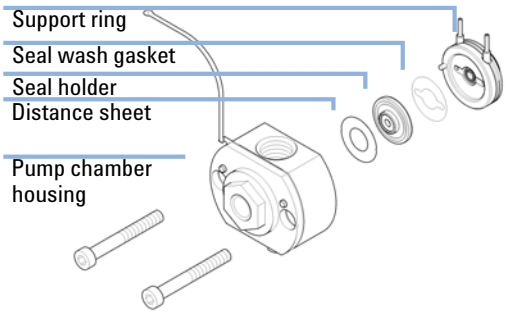
➔ Do not try to remove the pump piston from the rear.

➔ Do not use the piston for removing pump seals.

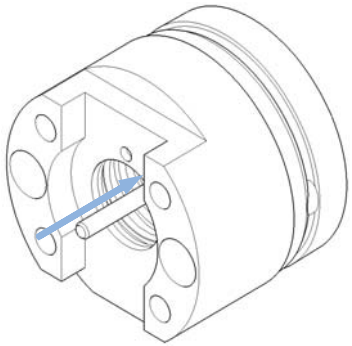
1 For disassembling the pump head, remove the 4 hex screws at the rear of the pump head.



2 Remove the front part of the pump head including pump chamber housing, distance sheet, pump seal and seal holder, and support ring with wash seal and gasket.



3 Remove the piston from the piston housing by pushing it to the rear, then pull it out from the rear.

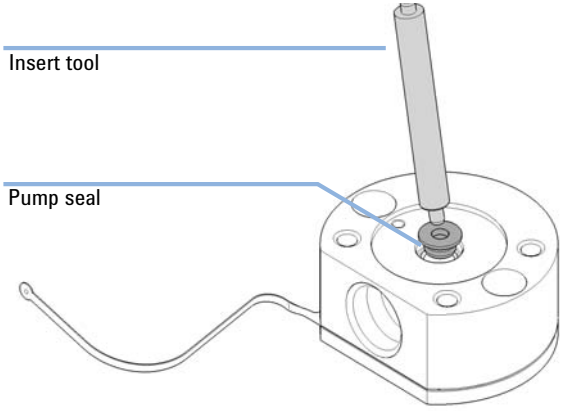


4 Check the pump pistons for scratches, grooves and dents when changing the piston seals.

NOTE

Damaged pistons cause micro leaks and will decrease the lifetime of the seals.

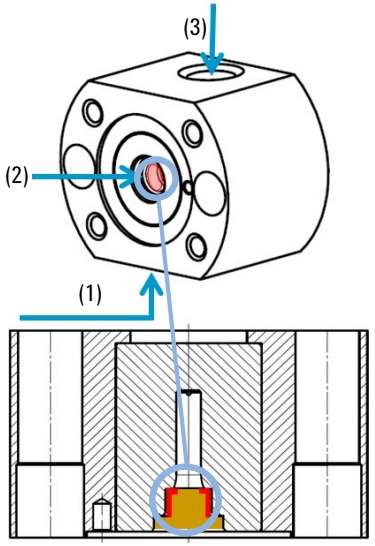
5 Use the steel side of the insert tool for removing the pump seal from the pump chamber housing.



NOTE

Do not use the pump piston for that purpose, as this can break it!

6 To flush out particles from the pump head, use pressurized air ((1), (2) and (3)).



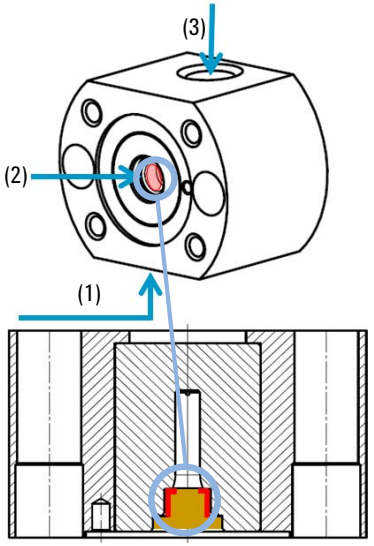
NOTE

Pump head parts in contact with the piston seal need to be cleaned properly in order to get a smooth surface and a tight connection.

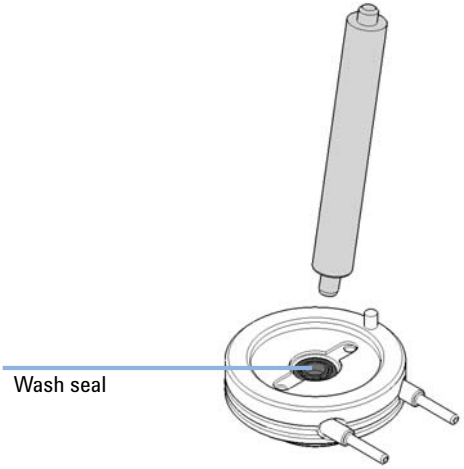
7 To remove wear, use isopropanol.

8 To clean the piston and the pump head sufrace, use the ultra fine abrasive mesh (p/n 8660-0852).

9 To dry the pump head and to remove residues, use pressurized air ((1), (2) and (3)).



10 If the wash seal shall be replaced by a new one, use the steel side of the insert tool for removing it.



Replacing the Heat Exchanger

Tools required

Description
Wrench, 19 mm

Parts required

p/n	Description
G4220-81013	Heat Exchanger (secondary pump head only)
G4220-20028	Headless screw for 1290 Infinity pump heads
G4220-20001	Spacer Fitting

Preparations

- Remove the pump head assembly from the pump
- Remove the secondary pump head from the link plate

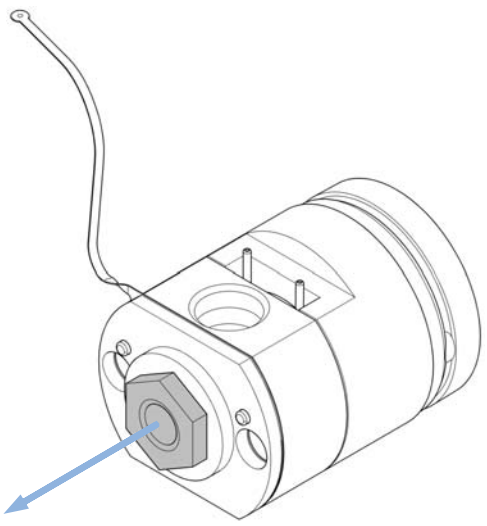
CAUTION

Loss of small spacer fitting

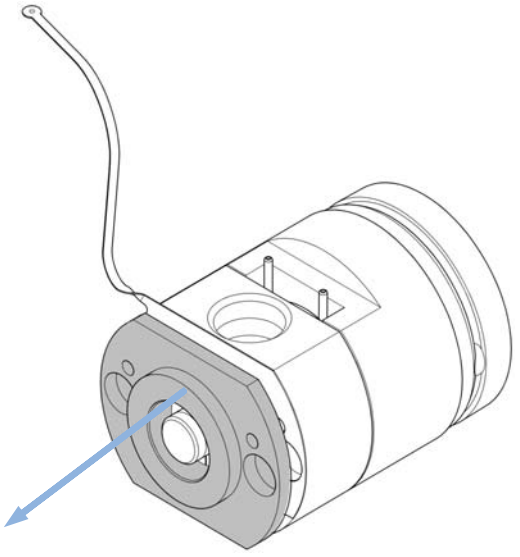
Inside the secondary pump head is a small spacer fitting, which can be dropped easily when removing the heat exchanger.

➔ The heat exchanger does not need to be removed for pump head maintenance.

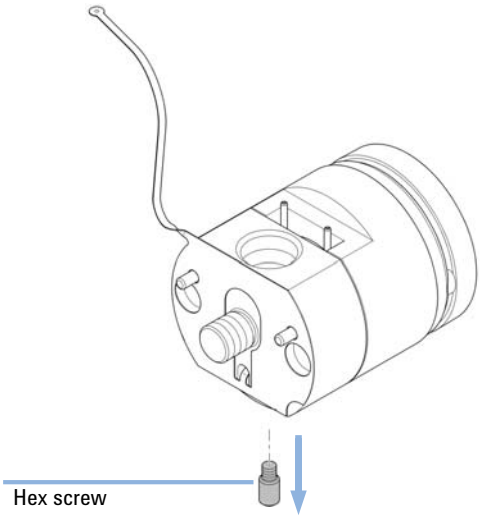
1 Remove the 19 mm screw at the front of the secondary pump head.



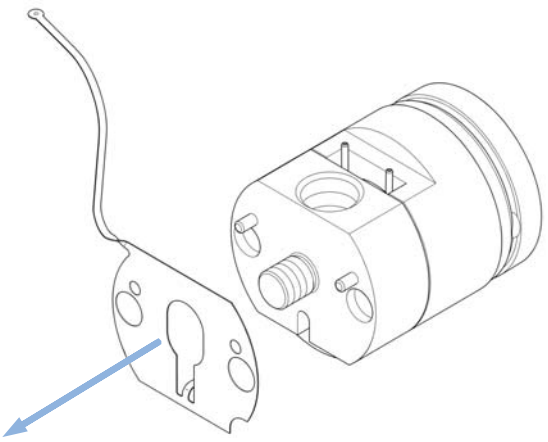
2 Remove the front plate.



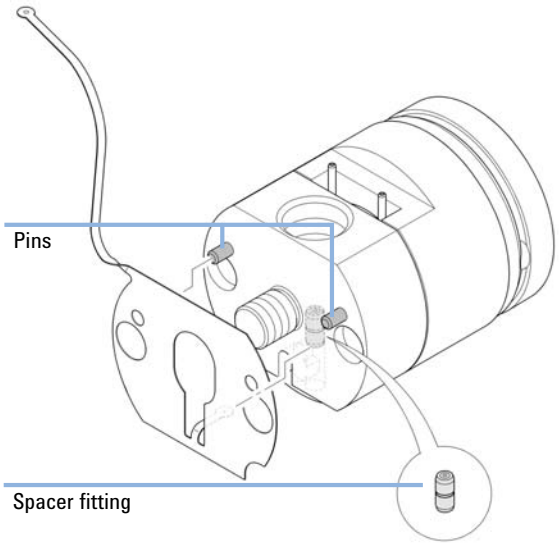
3 Remove the 2.5 mm hex screw at the bottom of the pump head. Do not drop the golden spacer fitting.



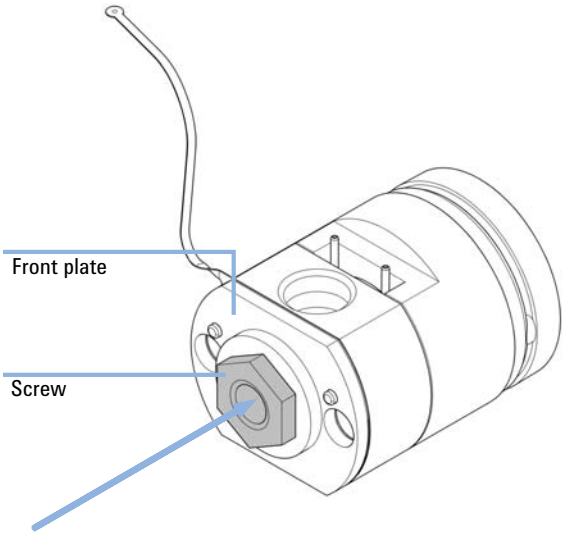
4 Lift out the heat exchanger.

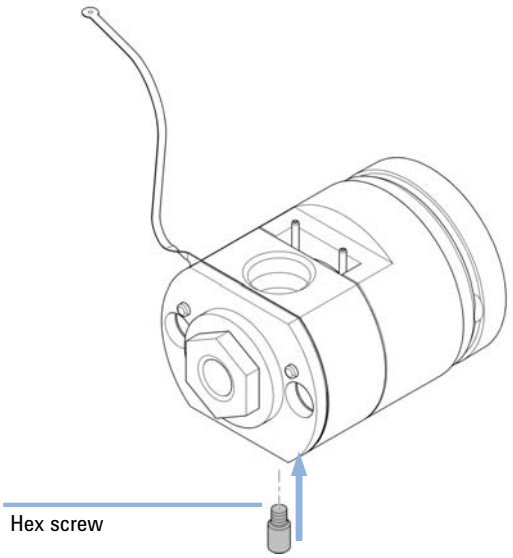


5 If removed, first insert the spacer fitting. Then insert the new heat exchanger to the opening in the pump head and lift it over the pins.



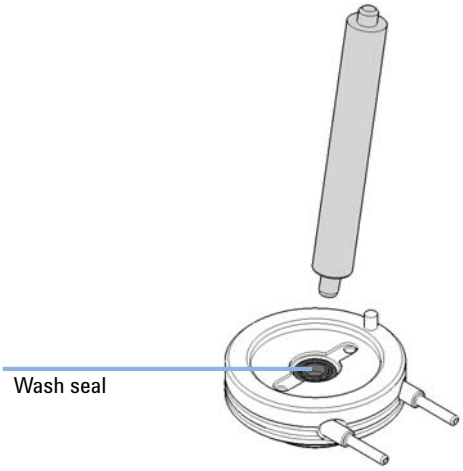
6 Use the 19 mm screw for fixing the front plate.



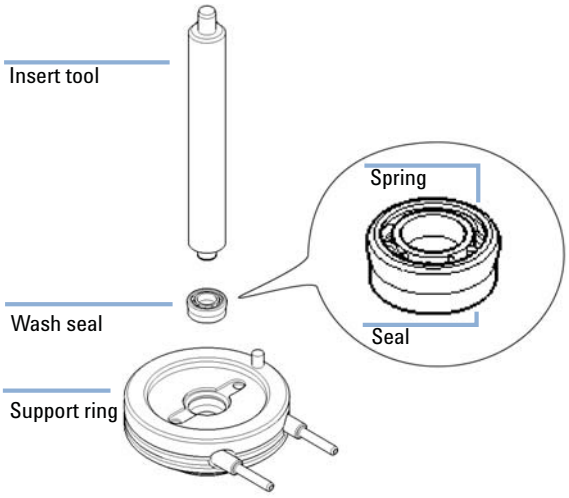
7 Insert and fix the 2.5 mm hex screw.  	

Replace Wash Seal and Gasket

1 To remove the wash seal use the steel side of the insert tool.



2 Use the soft plastic side of the insert tool for inserting the wash seal into the support ring.



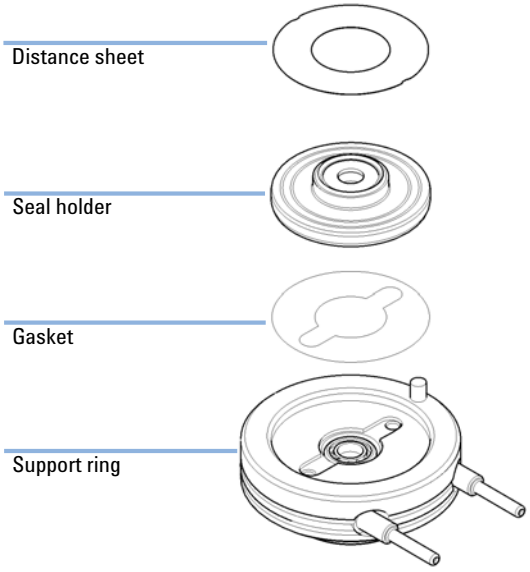
NOTE

Clean seals before Reinstallation or use new ones.

HINT

Store seals in isopropanol bath before installation.

3 Put the gasket into the support ring and insert the seal holder.



Assemble the Primary and Secondary Pump Head

This procedure describes how to assemble the secondary pump head using the pump head alignment tool. Assembling the primary pump head can be done accordingly. The secondary pump head has the heat exchanger capillary, which must fit into the openings of the alignment tool, whereas the primary pump head does not have a heat exchanger.

When Before installing the pump head.

Tools required

p/n	Description
	Pump head alignment tool
G4220-20012	Torque wrench 2 – 25 Nm
G4220-20013	4 mm hex bit
G4220-20041	Bit Torx 10x25 mm
G4220-20015	Adapter ¼ in square to hex
01018-23702	Insert tool

Parts required

p/n	Description
0905-1719	Metering seal 100 µL
0905-1718	Wash Seal PE
5062-2484	Gasket, seal wash (pack of 6)

See chapter *"Parts"* for details.

CAUTION

Damage of the pump piston

The pump piston is very sensitive to shearing forces from the side.

➔ Use the alignment piston of the pump head alignment tool for the alignment procedure described below.

CAUTION

Wrong orientation of pins on support ring

Assembling the pump head without paying attention to the correct orientation of the pins on the support ring can lead to leaks or damage of the piston and pump head.

➔ Observe pins on the support ring, which help assembling the parts of the pump head in the correct orientation.

CAUTION

Damage of the pump head assembly

When installing the pump head assembly, the pump drives need to be in maintenance position, where they are retracted. Using the pump drive in default position will damage the pump head assembly.

➔ Bring the pump drive to the maintenance position.

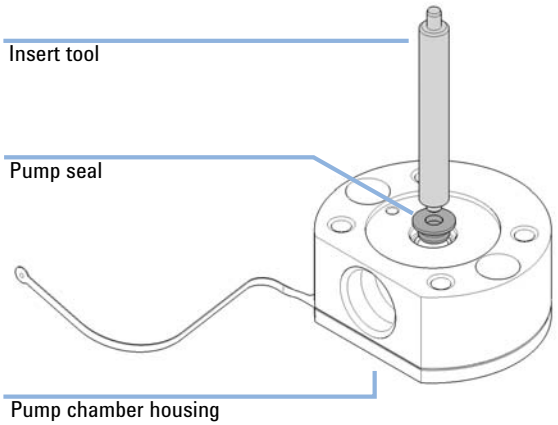
CAUTION

Damage to the pump head

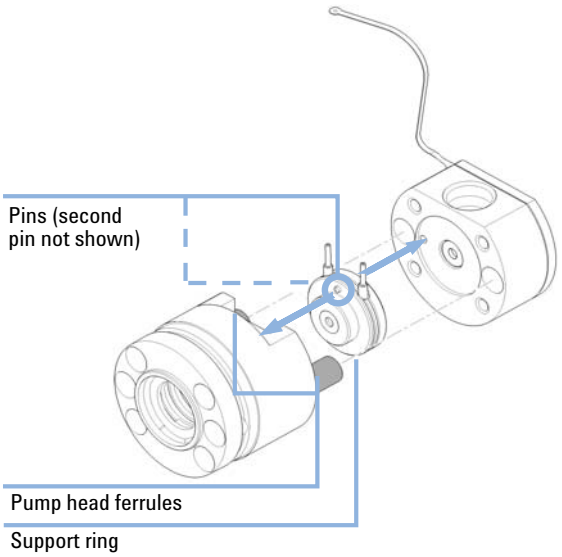
Using a wrong torque will damage the pump head.

➔ For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.

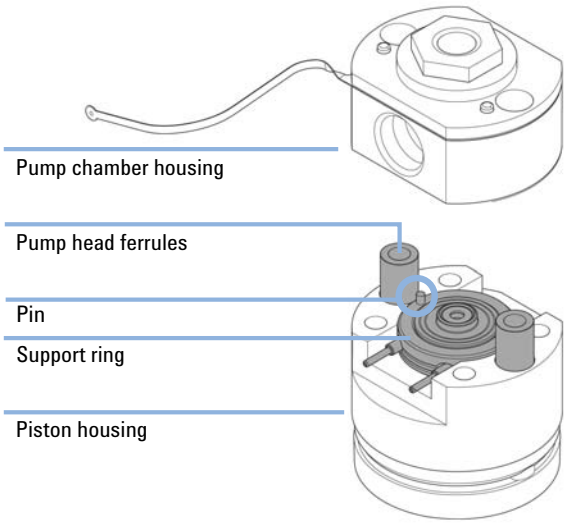
1 Use the soft plastic side of the insert tool for inserting the piston seal to the pump chamber housing.



2 Insert the support ring and pump head ferrules into the piston housing. Observe the pins on the support ring, which help you assembling the pump head correctly.



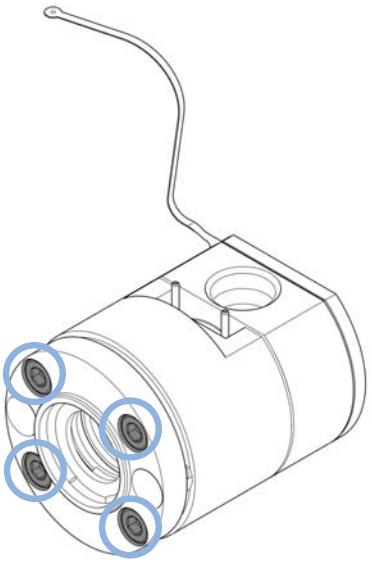
3 Assemble the pump head by putting the pump chamber housing on top of the support ring. Observe correct orientation of the pin.



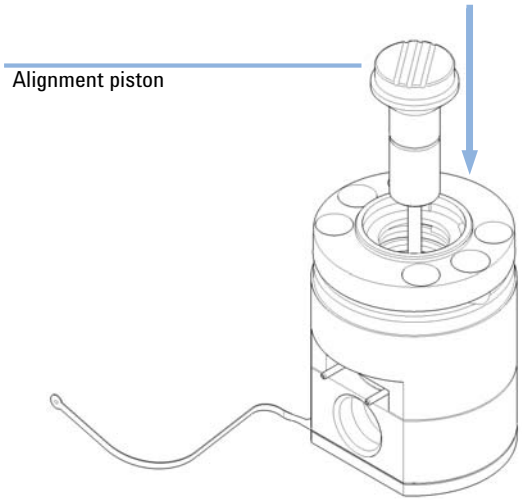
NOTE

Do NOT install the inlet and outlet valves and the outlet filter at this stage.

4 Loosely close the 4 screws at the rear of the pump head. The screws will be fixed tightly later.



5 Insert the alignment piston of the pump head alignment tool.



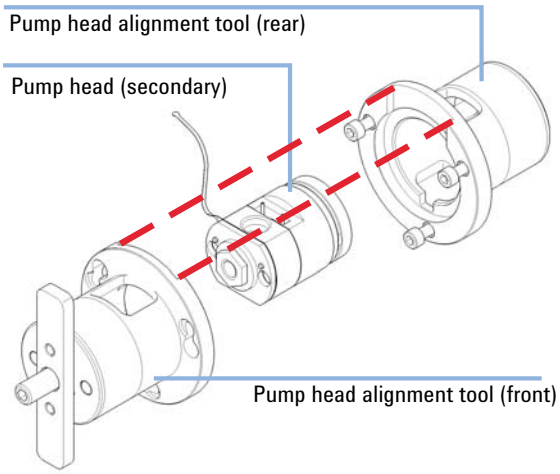
CAUTION

Damage to the pump head.

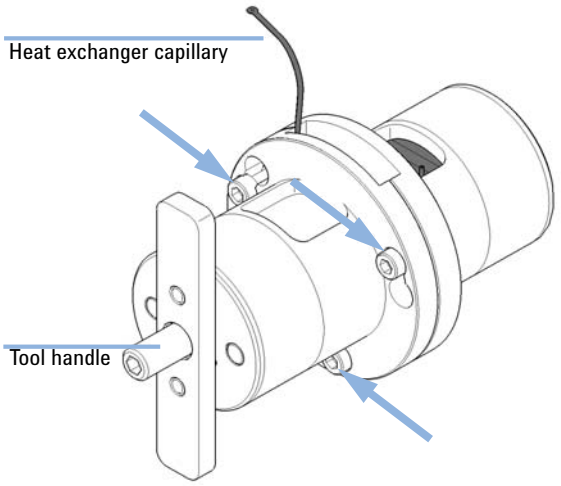
➔ **Using the alignment tool is mandatory.**

➔ **Not using will break the pump head.**

6 Insert the pump head to the pump head alignment tool, which is included to the 1290 Infinity Service Kit p/n 5067-4699. There are openings for the seal wash support ring and heat exchanger of the secondary pump head. Observe the correct orientation of all parts.



7 Close the tool by closing the 3 screws at the connection ring.

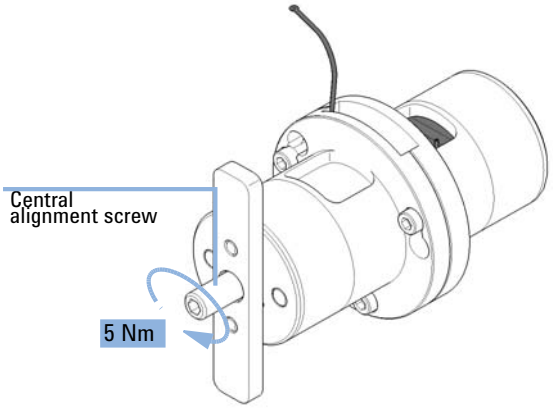


CAUTION

Damage to the pump head
Using a wrong torque will damage the pump head.

→ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

8 Using a torque key, which is included to the 1290 Infinity Service Kit p/n 5067-4699, set 5 Nm and fix the central alignment screw.

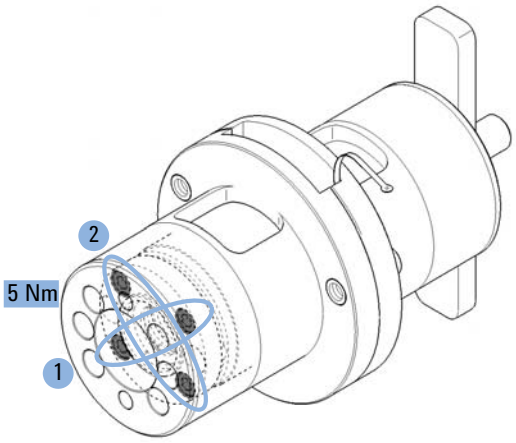


CAUTION

Damage to the pump head
Using a wrong torque will damage the pump head.

➔ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

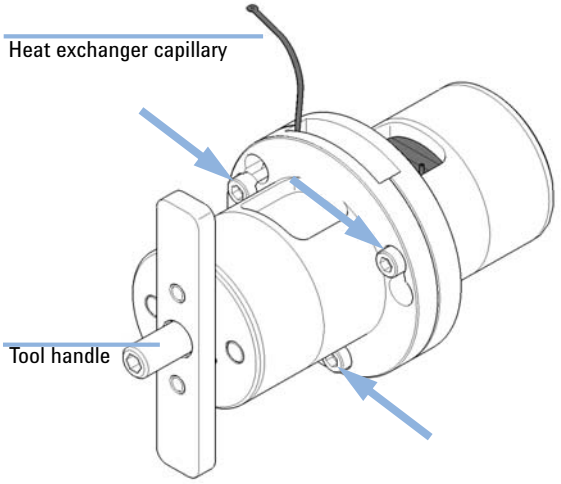
9 Using a torque key, which is included to the 1290 Infinity Service Kit p/n 5067-4699, set 5 Nm and fix the 4 screws at the rear of the alignment tool. Tighten screws crosswise.



NOTE

This procedure will align pump head parts to their correct positions and close the pump head tightly.

10 Open the 3 screws which have closed the pump head alignment tool and take out the aligned pump head. In case the pump head sticks inside the alignment tool, you can use the handle and insert it to the rear of the tool for pushing out the pump head.

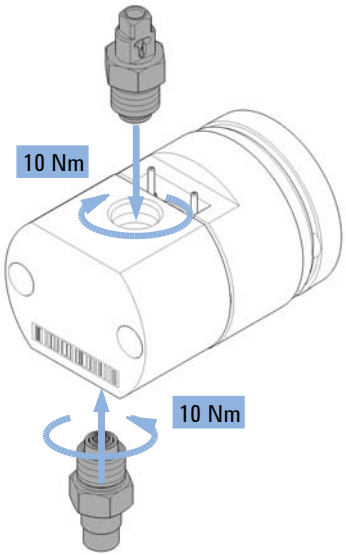


CAUTION

Damage to the pump head
Using a wrong torque will damage the pump head.

➔ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

11 For the primary pump head, install the inlet valve and outlet valve using the torque wrench, which is included to the 1290 Infinity Service Kit p/n 5067-4699. Set 10 Nm for the inlet valve and 10 Nm for the outlet valve.

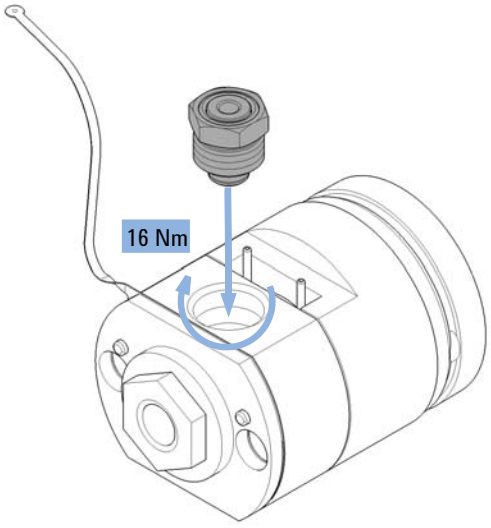


CAUTION

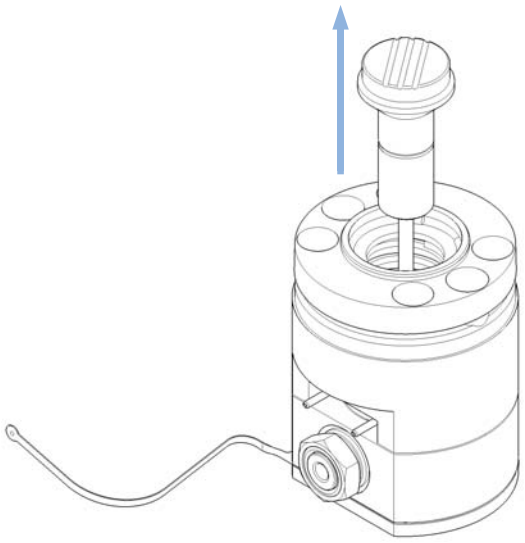
Damage to the pump head
Using a wrong torque will damage the pump head.

➔ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

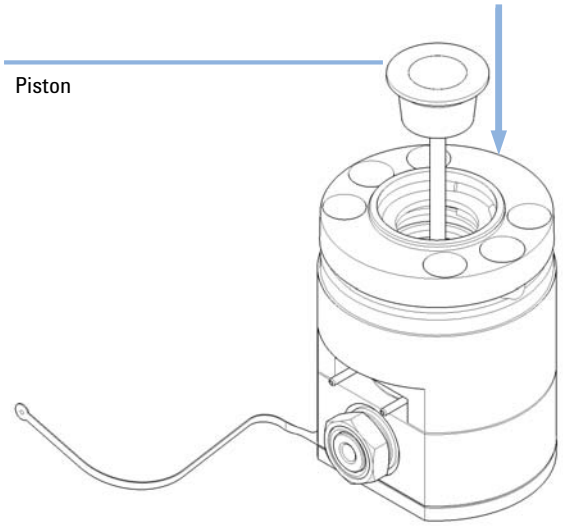
12 For the secondary pump head, install the outlet filter adapter using the torque wrench (14 mm hex bit), which is included to the 1290 Infinity Service Kit p/n 5067-4699, set to 16 Nm.



13 Remove the alignment piston.

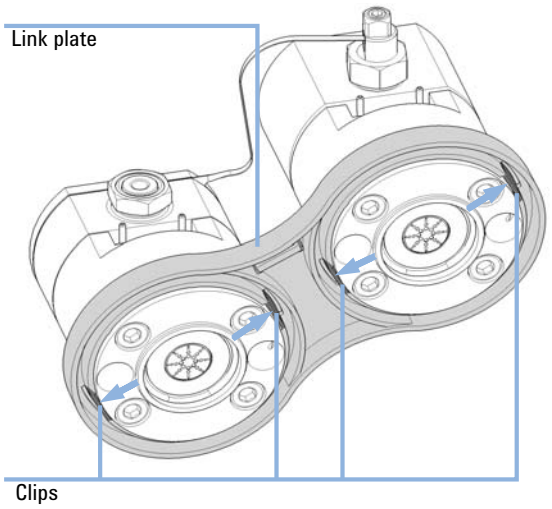


14 Insert the pump piston.



Reassemble the Pump Head Assembly

1 Insert both pump heads to the link plate and make sure that the clips snap in that fix the pump heads.



NOTE

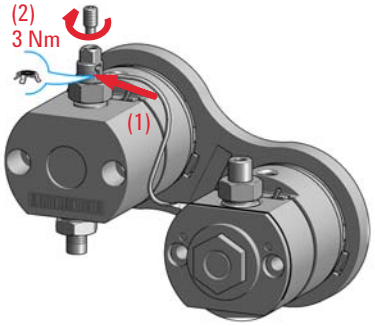
Observe the correct orientation of the primary and the secondary pump head. This is important for correct fixation of the heat exchanger and the capillaries, as described in the following steps.

CAUTION

Damage to the pump head
Using a wrong torque will damage the pump head.

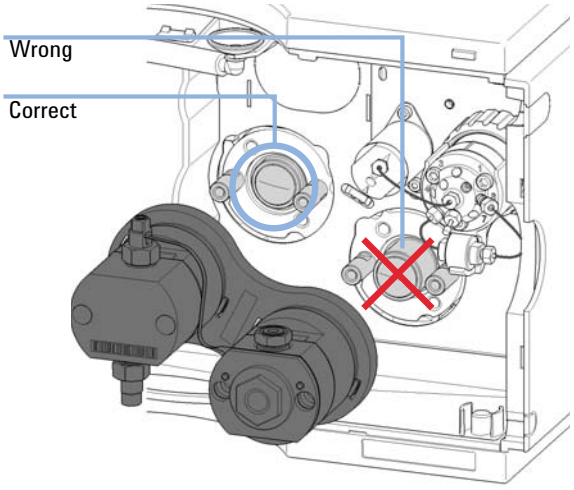
➔ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

2 Insert the heat exchanger capillary into the outlet of the primary pump head. Using a torque key, which is included to the 1290 Infinity Service Kit p/n 5067-4699, set 3 Nm and close the hex screw at the top of the outlet.



Install the Pump Head Assembly

1 Bring the pump drive to the maintenance position using the Lab Advisor user interface: Go to **Tools > Remove/Install Pump Head** and follow instructions given on the screen. Both pump drives must be retracted.

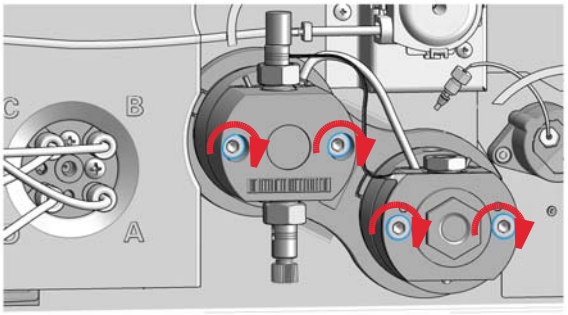


CAUTION

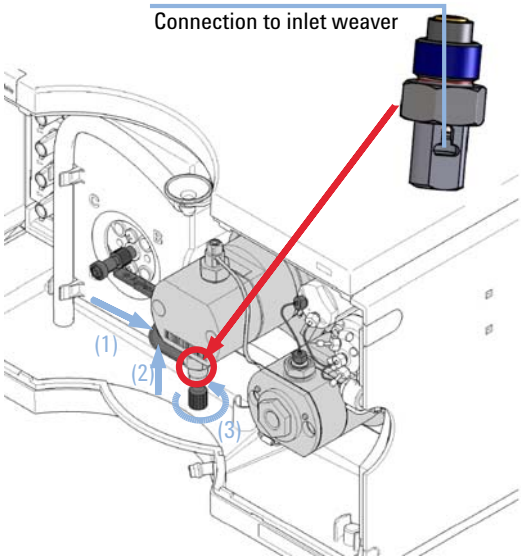
Damage to the pump head
Using a wrong torque will damage the pump head.

➔ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

2 Install the new pump head assembly by tightening the screws step by step. Apply 5 Nm using a torque hex key, which is included to the 1290 Infinity Service Kit p/n 5067-4699.

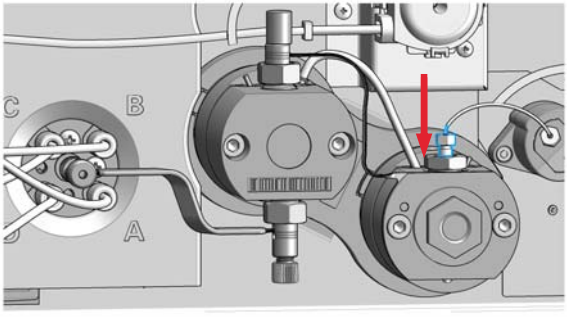


3 Insert the new inlet weaver to the inlet valve (1, 2). Fix the weaver with the plastic screw to the inlet valve (3).

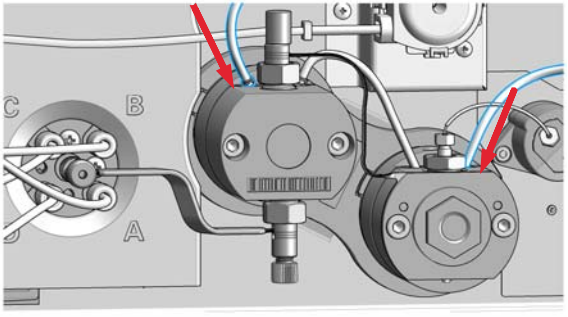


4 Reconnect solvent tubes for channels A-D from the MCGV to the degasser outlets.

5 Connect the capillary from the outlet filter adapter on the secondary pump head to the pressure sensor.



6 Connect the seal wash tubes.



Next Steps:

7 Close the doors.

8 Perform a Pump Leak Rate Test and a System Pressure Test.

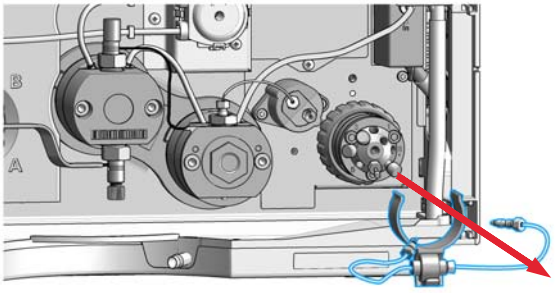
Replace the Multi Purpose Valve

Tools required	p/n	Description
	5023-0240	Hex driver, ¼", slitted

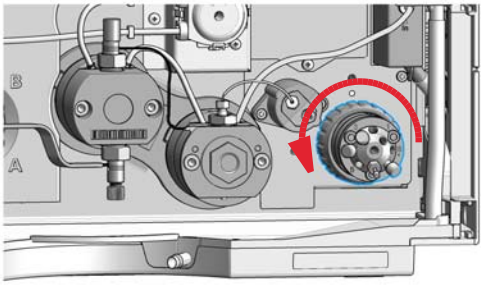
Parts required	p/n	Description
	0100-1259	Blank nut (plastic)
	01080-83202	Blank nut (stainless steel)
	5067-4237	Multi Purpose Valve Head

Preparations Remove all capillary connections from the Multi Purpose Valve.

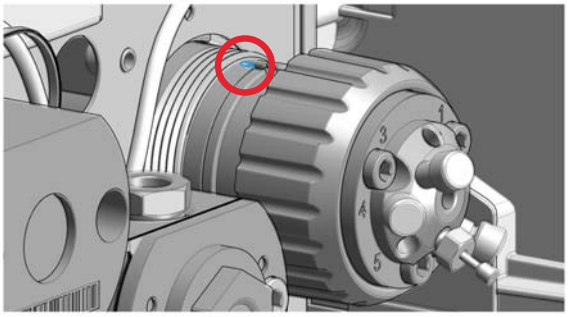
1 Remove the clamp with the inline filter.

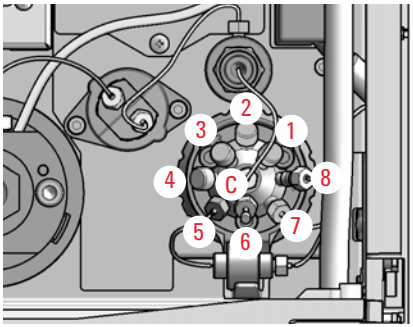


2 Unscrew the black union nut and remove the head of the purge valve by pulling it to the front.



3 Put the new valve head onto the valve drive such that the lobe fits to the groove. Screw the valve head onto the valve drive using the union nut.





The central (C) port is connected to the outlet of the pressure sensor.

- Port 1 is connected to the outlet of the optional Jet Weaver
- Port 2 is connected to the inlet of the optional Jet Weaver
- Port 3 is blocked by a blank nut (plastic)
- Port 4 is connected to the system (typically multisampler)
- Port 5 is connected to the outlet of the inline filter
- Port 6 is blocked by a blank nut (SST)
- Port 7 is connected to the waste capillary
- Port 8 is connected to the inlet of the inline filter

Block unused ports with blank nuts.

Replace Parts of the Multi Purpose Valve

Tools required	p/n	Description
	8710-2394	9/64 inch hex key

Parts required	p/n	Description
	1535-4045	Bearing ring
	5068-0202	Rotor seal, Multi Purpose Valve, 1300 bar
	5068-0120	Stator ring
	5068-0001	Stator head
	1535-4857	Stator screws, 10/Pk

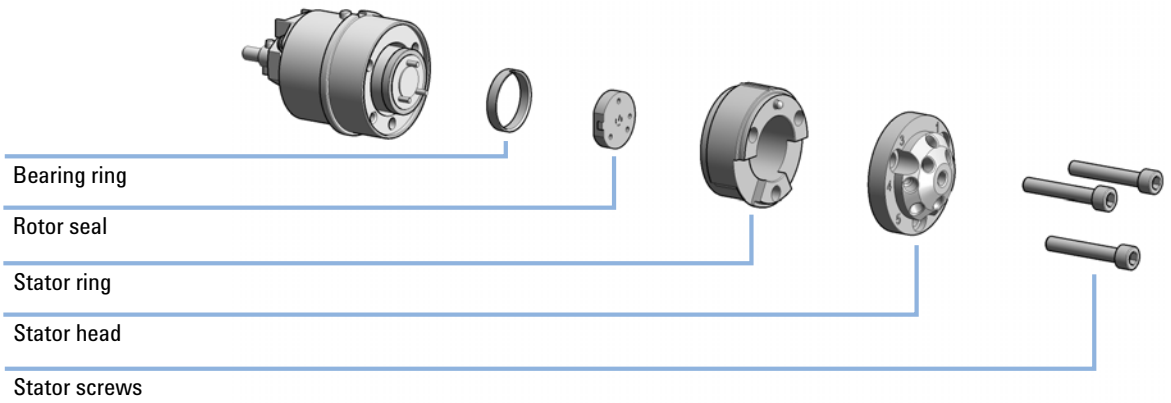
Preparations

- Remove capillary connections from ports 1, 3 and 6.
- Remove the clamp with the inline filter.

1 Use the 9/64 inch hex key for opening the valve head.

2 Replace parts as required.

3 Reassemble the valve head and mount it to the valve drive.



Replace the High Pressure Outlet Filter or Filter Frit

When

For removing blockages and leaks in the high pressure filter assembly. The outlet filter should be replaced as required depending on the system usage. Other parts are covered by the Agilent Preventive Maintenance (PM) Service.

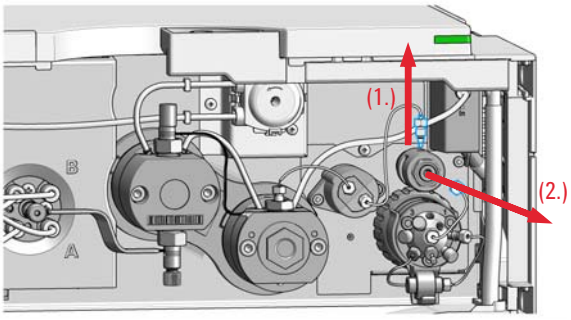
Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch
8710-1924	Wrench open 14 mm
	Torque wrench
	Torque wrench head, 14 mm for torque wrench

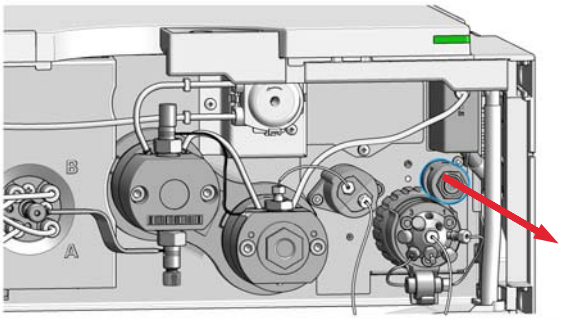
Parts required

p/n	Description
G4204-60004	Outlet filter 1290 Infinity Quaternary Pump
5067-5716	Frit for 1290 pump outlet filter 2/pk

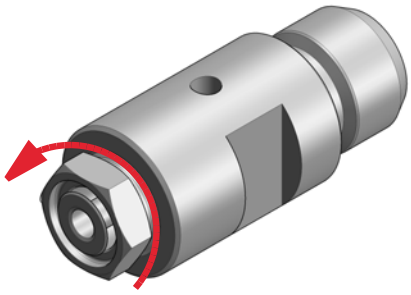
1 Remove the capillary from the high pressure outlet filter to the pressure sensor (1) and from the high pressure outlet filter to the Multipurpose valve (2).



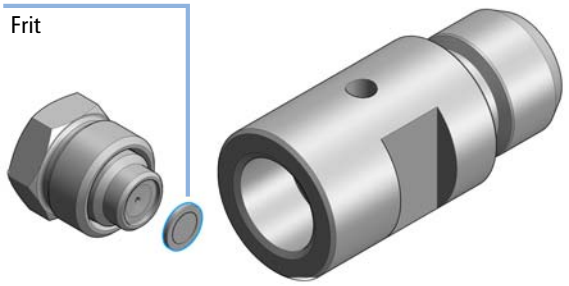
2 Remove the high pressure outlet filter from the filter holder .



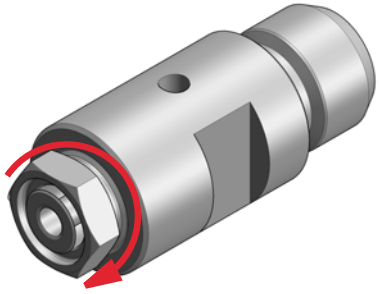
3 Unscrew the high pressure outlet filter.



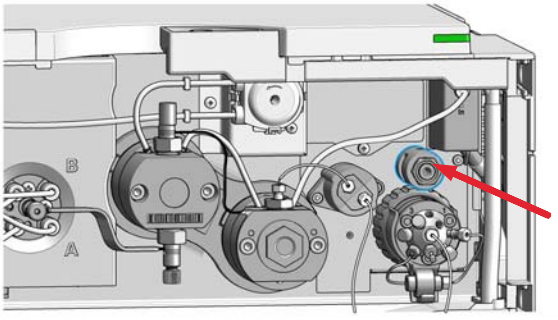
4 Replace the filter frit.



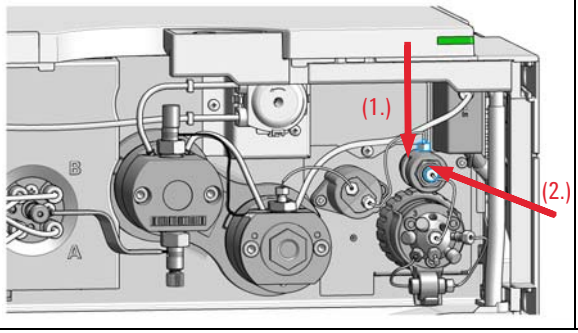
5 Mount the high pressure outlet filter using a torque wrench set to 16 Nm.



6 Reinstall the high pressure outlet filter to the filter holder.



7 Mount the capillary connection to the pressure sensor (1) and to the Multipurpose valve (2).



Replace Parts of the Inline Filter

Tools required	p/n	Description
	8710-0510	Wrench open 1/4 — 5/16 inch

Parts required	p/n	Description
	5067-5407	In-Line Filter Assembly for 1290 Infinity Quaternary Pump
	5067-4748	Capillary ST, 0.17 mm x 90 mm Multi Purpose Valve to inline filter
	5023-0271	Frit 0.3 µm for inline filter, 5/pk

CAUTION

Stuck Capillary in Multi Purpose Valve

Shortcutting the inline filter by directly connecting its right capillary to valve port 5 can damage the Multi Purpose Valve.

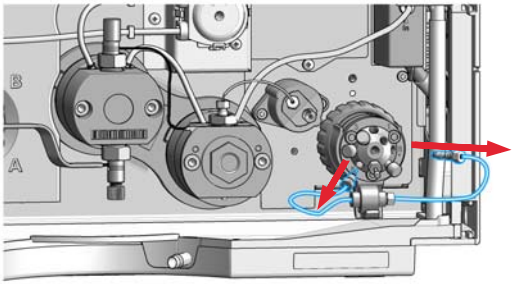
The size/position of this capillary in its fitting is incompatible, so it may get stuck irreversibly to the valve.

➔ Do not shortcut the filter by directly connecting its right capillary to valve port 5 in case the inline filter cannot or shall not be used.

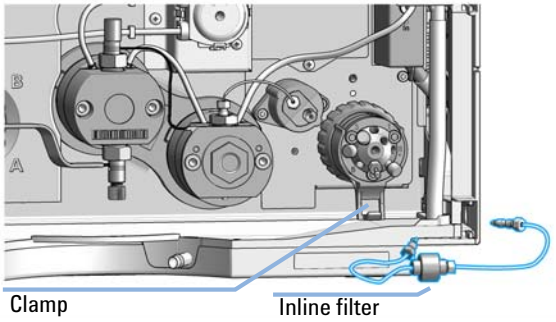
NOTE

The inline filter can be cleaned using the back-flush function in the user interface of your Agilent instrument control software.

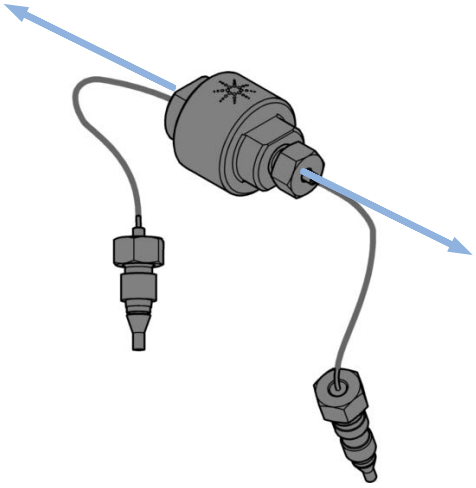
1 Remove the capillaries from the Multi Purpose Valve to the inline filter.



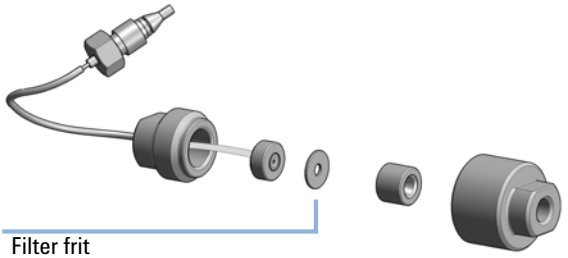
2 Remove the inline filter from the clamp attached to the Multi Purpose Valve.



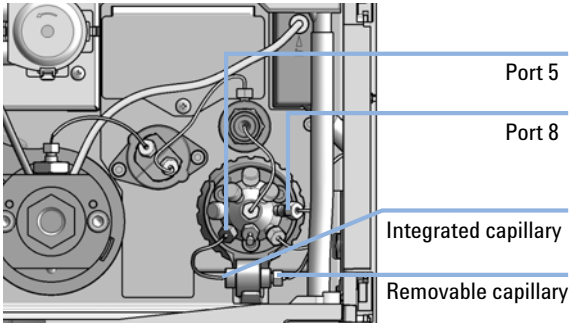
3 Use two 5/16 wrenches for opening the inline filter.



4 Replace the filter frit and reassemble the inline filter.



5 Put the inline filter to the clamp and install its capillaries. The integrated capillary is connected to port 5 of the Multi Purpose Valve. The removable capillary is connected to port 8.



Replace the Module Firmware

When

The installation of newer firmware might be necessary
- if a newer version solves problems of older versions or
- to keep all systems on the same (validated) revision.

The installation of older firmware might be necessary
- to keep all systems on the same (validated) revision or
- if a new module with newer firmware is added to a system or
- if third party control software requires a special version.

Tools required

	Description
	Agilent Lab Advisor software
OR	Instant Pilot G4208A (only if supported by module)

Parts required

#	Description
1	Firmware, tools and documentation from Agilent web site

Preparations

Read update documentation provided with the Firmware Update Tool.

To upgrade/downgrade the module's firmware carry out the following steps:

1 Download the required module firmware, the latest LAN/USB FW Update Tool and the documentation from the Agilent web.
http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

2 For loading the firmware into the module follow the instructions in the documentation.

Module Specific Information

There is no specific information for this module.

Prepare the Pump Module for Transport

When If the module shall be transported or shipped.

Parts required

p/n	Description
9301-0411	Syringe; Plastic
9301-1337	Syringe adapter
G7104-44000	Transport protection foam

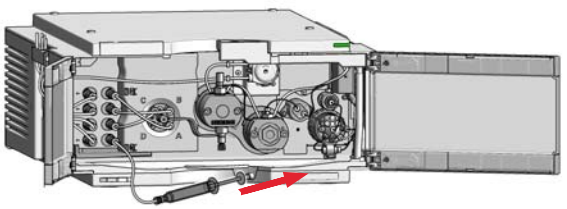
CAUTION

Mechanical damage

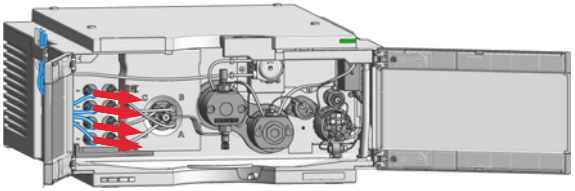
➔ For shipping the module, insert the Protective Foam to protected the module from mechanical damage.

➔ Be careful not to damage tubing or capillary connections while inserting the module in the Protective Foam.

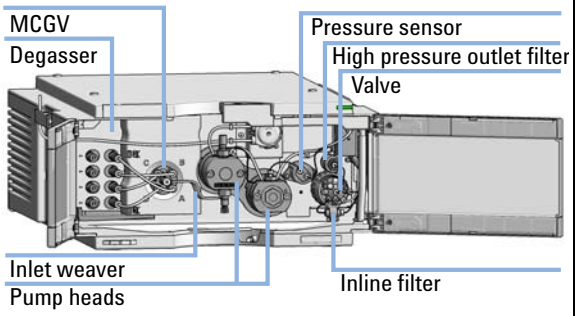
1. Flush all solvent channels with isopropanol.
2. Remove solvent inlet tubes from solvent reservoirs and tubing clips at other modules.
3. Remove tubings between the seal wash function and solvent bottle/waste.
4. Turn off the pump.
5. Remove cable and capillary connections to other modules.
6. Remove the waste tube.
7. Remove the module from the stack.
8. Disconnect the degasser outlet tubings at the MCGV one after another. Use a syringe for removing liquid from the degasser and the solvent tubings.



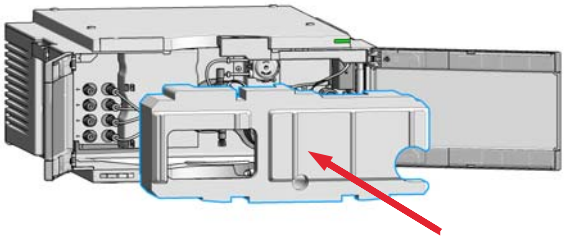
9 Reconnect the degasser outlet tubings to the MCGV. Remove the degasser inlet tubings.



10 You may keep internal tubing and capillary connections.



11 Carefully insert the protective foam to the front part of the instrument. Do not damage any tubing or capillary connections.



Next Steps:

12 Close the doors.

13 For transport or shipment, put the module and accessory kit to the original shipment box.

8
Parts and Materials

Overview of Main Assemblies 144
Flow Connections 146
Pump Head Assembly Parts 148
Primary Pump Head Parts 150
Secondary Pump Head Parts 152
Multi Purpose Valve 154
Cover Parts 155
Accessory Kit 156
Tool Kit 157
Tools 158

This chapter provides information on parts for maintenance and repair.

Overview of Main Assemblies

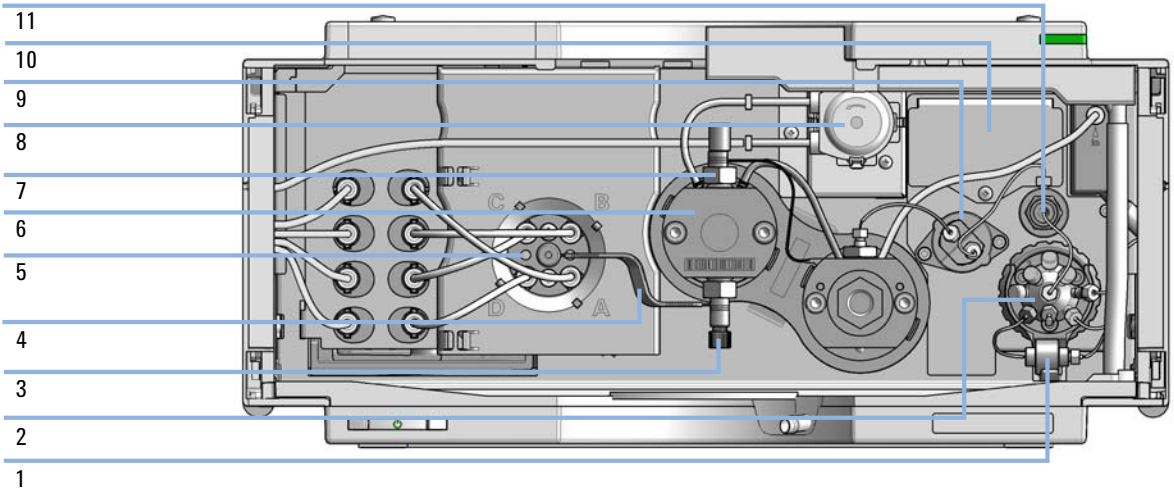


Figure 11 Overview of main assemblies

Item	p/n	Description
1	5067-5407	In-Line Filter Assembly for 1290 Infinity Quaternary Pump
	5023-0271	Frit 0.3 µm for inline filter, 5/pk
	G4204-40000	Clamp for In-Line Filter
2	5067-4237	Multi Purpose Valve Head
3	G4204-60022	Inlet Valve 1290 Infinity Quaternary Pump
4	G4204-81090	1290 Infinity Quaternary Pump Inlet Weaver Assembly
5	G1311-67701	Multi channel gradient valve (MCGV)
	5041-8365	Blank plug for MCGV
6	G4204-60600	Pump head assembly (G7104A)
7	G4220-60028	Outlet valve (primary pump head)
8	5065-4445	Peristaltic pump with Pharmed tubing
9	G7104-60001	Pressure sensor 1300 bar
10	G4204-68000	Jet Weaver 380 µL for 1290 Infinity Quaternary Pump (OPTIONAL)
11	G4204-60004	Outlet filter 1290 Infinity Quaternary Pump
	5067-5716	Frit for 1290 pump outlet filter 2/pk

Flow Connections

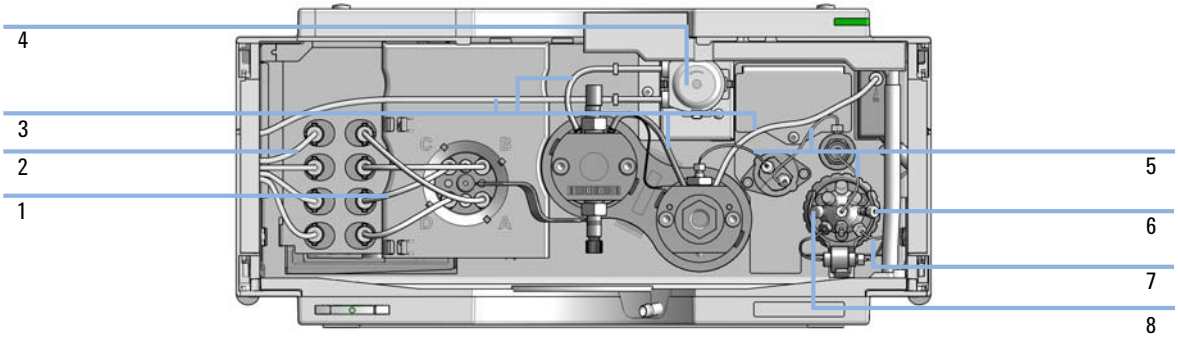
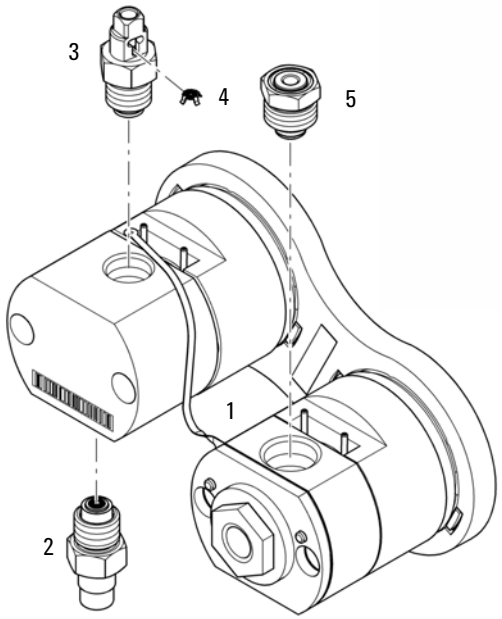


Figure 12 Flow connections of the pump

Item	p/n	Description
1	G4220-60035	Tubing kit 140 mm, 2/pk Degasser to MCGV
2	G7120-60007	Bottle Head Assembly
	5067-5760	Solvent Cabinet Kit (not shown)
3	5065-9978	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m
4	5065-4445	Peristaltic pump with Pharmed tubing
5	5067-4656	Capillary ST, 0.25 mm x 80 mm Pressure Sensor to Outlet Filter, to Pump Head, and to Multi Purpose Valve
6	5067-4748	Capillary ST, 0.17 mm x 90 mm Multi Purpose Valve to Inline Filter
7	G4220-67000	Waste Tubing with Fitting
8	5500-1217	Capillary ST 0.17 mmx900 mm SI/SX ps-ps Pump to Multisampler
	5067-6129	Capillary ST 0.17 x 300 mm S/SX
	5067-5416	Capillary ST 0.17 x 120 mm, SLV/SV for Jet Weaver (not shown)

Pump Head Assembly Parts



Item	p/n	Description
1	G4220-81013	Heat Exchanger (secondary pump head only) Channel A
2	G4220-60022	Inlet valve (primary pump head)
3	G4220-60028	Outlet valve (primary pump head)
4	G4220-20020	Internal gold seal for Outlet Valve
5		Adapter

Primary Pump Head Parts

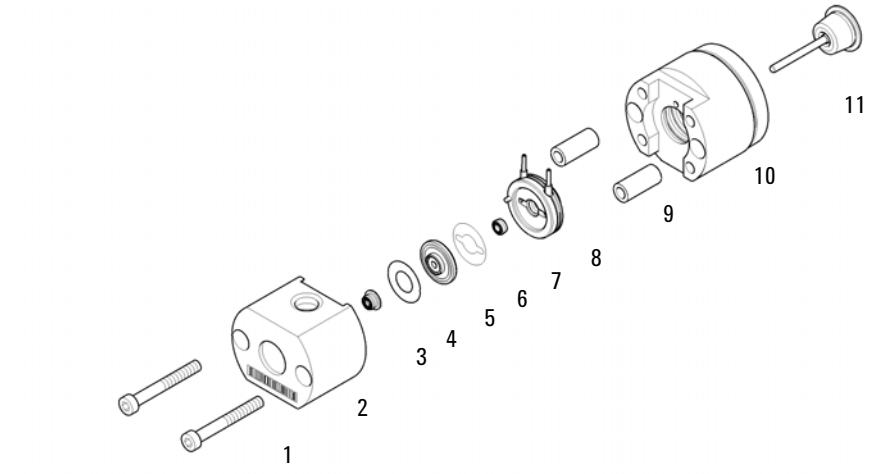


Figure 13 Primary pump head parts

Primary Head G4204-60060

Item	p/n	Description
1	0515-1218	Screw M5, 40 mm long
2	G4204-60033	PH Body prim
3	0905-1719	Metering seal 100 µL
4	5023-2513	Distance sheet
5	G4220-60016	Seal holder including backup ring
6	01018-07102	Gasket (Seal wash)
7	0905-1718	Backup Seal PE (Seal Wash)
8	G4220-63010	Support Ring (Seal Wash)
9	G4220-23705	Bracket
10	G4220-60000	Preload Assy
11	5067-5938	Plunger

Secondary Pump Head Parts

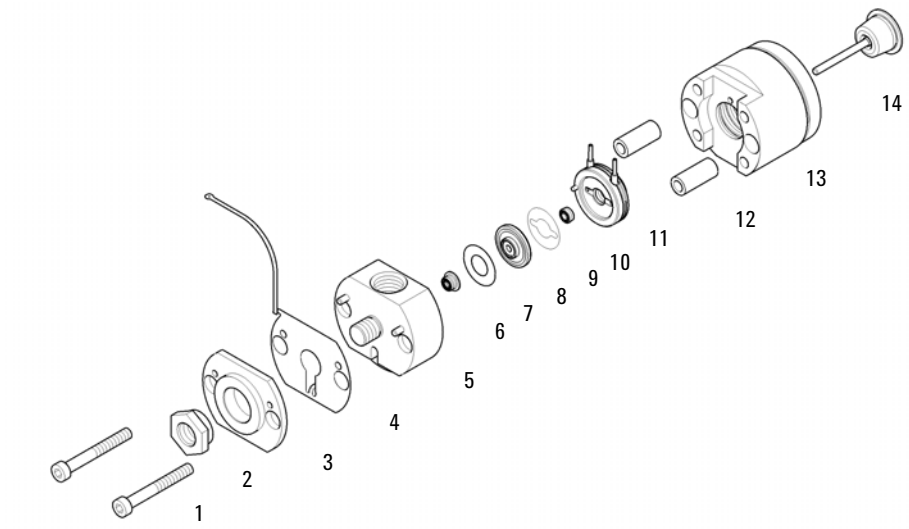


Figure 14 Secondary pump head parts

Secondary Head G4204-60061

Item	p/n	Description
1	0515-1218	Screw M5, 40 mm long
2	G4220-20003	Pump Head Screw
3	G4220-20000	LID
4	G4220-81013	Heat Exchanger
5	G2404-25213	PH Body sec
	G4220-20028	Headless screw for 1290 Infinity pump heads (not shown)
	G4220-20001	Spacer Fitting (not shown)
6	0905-1719	Metering seal 100 µL
7	5023-2513	Distance sheet
8	G4220-60016	Seal holder including backup ring
9	01018-07102	Gasket (Seal wash)
10	0905-1718	Backup Seal PE (Seal Wash)
11	G4220-63010	Support Ring (Seal Wash)
12	G4220-23705	Bracket
13	G4220-60000	Preload Assy
14	5067-5938	Plunger

Multi Purpose Valve

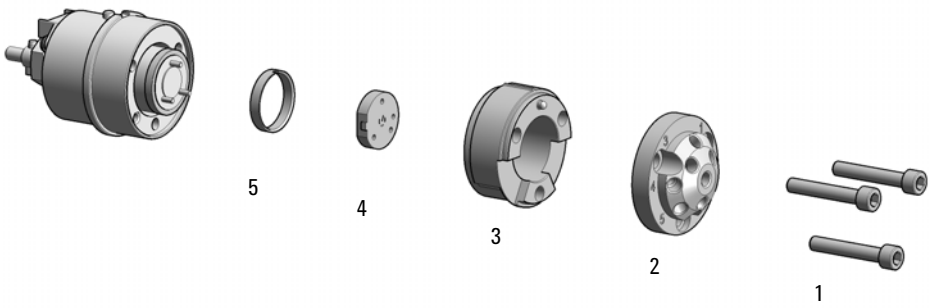


Figure 15 Multi Purpose Valve parts

Item	p/n	Description
1	1535-4857	Stator screws, 10/Pk
2	5068-0001	Stator head
3	5068-0120	Stator ring
4	5068-0202	Rotor seal, Multi Purpose Valve, 1300 bar
5	1535-4045	Bearing ring

Cover Parts

p/n	Description
G4224-60200	Side Cover Right 200
G4224-60201	Side Cover Left 200
5043-0286	Base Cover
5067-5908	Top Cover
5067-5767	Door assy 200 left IF II
5067-5768	Door assy 200 right IF II

Accessory Kit

G7104-68705

p/n	Description
0100-1816	Fitting Waste Tube to Purge Valve
0890-2207	Tubing/Sleeving-Flex
5023-0271	Frit 0.3 µm for inline filter, 5/pk
5043-1013	Tubing Clip
5063-6527	Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)
5067-4670	SST cap. 0.17 mm ID 600 mm pre-swaged
5067-5443	Inlet tubing
5181-1519	CAN cable, Agilent module to module, 1 m
5500-1155	Tube Connector, 90 degree, ID 6.4
5067-6129	Capillary ST 0.17 x 300 mm S/SX
9301-6476	Syringe with luerlock 5 mL Polypropylene
G1311-90107	Algae note
9301-1337	Syringe adapter
5500-1156	T-Tube Connector ID6.4
5500-1169	Y Tube Connector ID6.4

Tool Kit

p/n	Description
8720-0025	Wrench, 1/2 inch & 9/16 inch
8710-1924	Wrench open 14 mm
8710-2409	Wrench open end, 5/16 – 3/8 inch
8710-0510	Wrench open 1/4 — 5/16 inch
5023-2500	Wrench
8710-1534	Wrench, 4 mm both ends, open end
5043-1361	Hex Key Set Driver
5023-2499	Hex Key Set
8710-2394	Hex key 9/64 inch 15 cm long T-handle
8710-0899	Pozidriv screwdriver
5023-2501	Screwdriver Torx-T10
5023-2504	Hex driver SW-4 slitted
5023-2503	Hex driver SW-5 slitted
5023-2502	Hex driver 1/4 inch, slitted
9301-0411	Syringe; Plastic
9301-1337	Syringe adapter
0100-1710	Mounting Tool for Tubing Connections
0100-1681	Syringe adapter luer/barb
01018-23702	Insert tool
5067-6127	Blank Nut SL

Tools

Item	p/n	Description
	5067-4699	1290 Infinity pump service kit
1	5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
2	G4220-20013	4 mm hex bit
3	G4220-20014	2.5 mm Hex Bit
4	G4220-20015	Adapter ¼ in square to hex
	5067-5691	Wrench open, 19 mm
	G4220-20041	Bit Torx 10x25 mm
	5023-0285	Replacement kit for 1290 Infinity pump head alignment tool (piston/handle)

1290 Infinity pump service kit (5067-4699) includes pump head alignment tool and items 1 – 4.

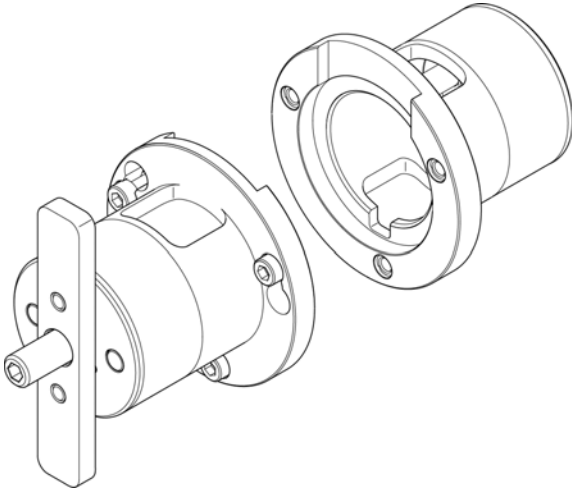


Figure 16 Pump head alignment tool

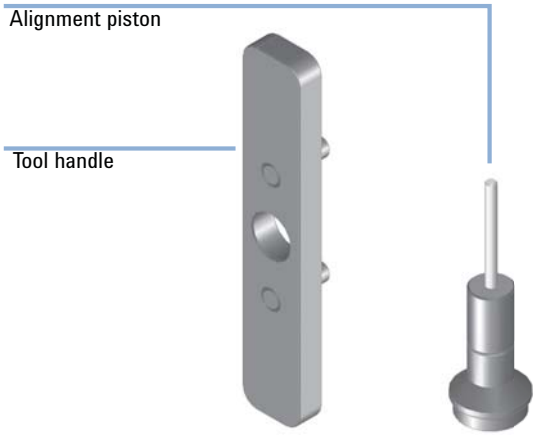


Figure 17 Replacement kit for 1290 Infinity pump head alignment tool (piston/handle)

Figure 18 HPLC System Tool Kit-Infinity-II

9
Identifying Cables

Cable Overview 162
Analog Cables 164
Remote Cables 166
CAN/LAN Cables 170
Agilent Module to PC 171
USB Cables 172

This chapter provides information on cables used with the modules.

Cable Overview

NOTE Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Analog cables

p/n	Description
35900-60750	Agilent 35900A A/D converter
01046-60105	Analog cable (BNC to general purpose, spade lugs)

Remote cables

p/n	Description
5188-8029	ERI to general purpose
5188-8044	Remote Cable ERI – ERI
5188-8045	Remote Cable APG – ERI
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	Agilent module to general purpose

CAN cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

LAN cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

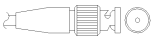
RS-232 cables (not for FUSION board)

p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

USB cables

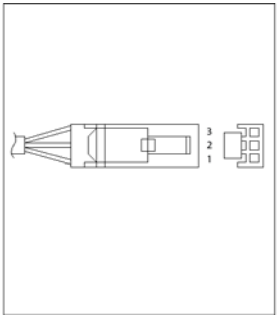
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables

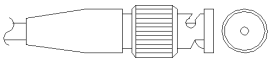


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

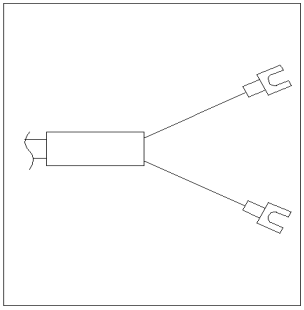
Agilent Module to 35900 A/D converters

p/n 35900-60750	35900	Pin Agilent module	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

Agilent Module to BNC Connector

p/n 8120-1840	Pin BNC	Pin Agilent module	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +

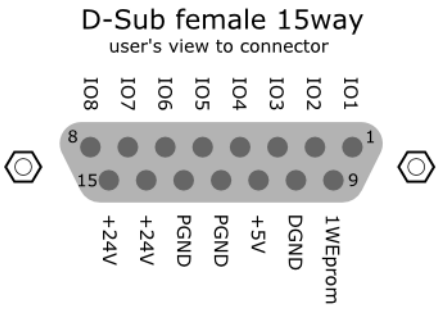
Agilent Module to General Purpose

p/n 01046-60105	Pin	Pin Agilent module	Signal Name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +

Remote Cables

ERI (Enhanced Remote Interface)

5188-8029 ERI to general purpose

p/n 5188-8029	pin	Enhanced Remote	Classic Remote
	1	IO1	START REQUEST
	2	IO2	STOP
	3	IO3	READY
	4	IO4	POWER ON
	5	IO5	NOT USED
	6	IO6	SHUT DOWN
	7	IO7	START
	8	IO8	PREPARE
	9	1wire DATA	
	10	DGND	
	11	+5V ERI out	
	12	PGND	
	13	PGND	
	14	+24V ERI out	
	15	+24V ERI out	

5188-8044 ERI to ERI (Connector D_Subminiature 15 pin)

Table 3 5188-8044 ERI to ERI

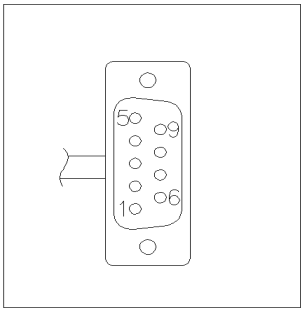
p/n 5188-8044	Pin (ERI)	Signal	Pin (ERI)
	10	GND	10
	1	Start Request	1
	2	Stop	2
	3	Ready	3
	5	Power on	5
	4	Future	4
	6	Shut Down	6
	7	Start	7
	8	Prepare	8
	Ground Connection	Cable Shielding	NC

5188-8045 ERI to APG (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG))

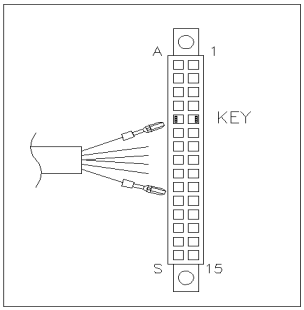
p/n 5188-8045	Pin (ERI)	Signal	Pin (APG)
	10	GND	1
	1	Start Request	9
	2	Stop	8
	3	Ready	7
	5	Power on	6
	4	Future	5
	6	Shut Down	4
	7	Start	3
	8	Prepare	2
	Ground Connection	Cable Shielding	NC

One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent modules. The other end depends on the instrument to be connected to.

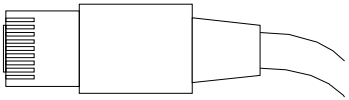
Agilent Module to Agilent 35900 A/D Converters

p/n 5061-3378	Pin 35900 A/D	Pin Agilent module	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

Agilent Module to General Purpose

p/n 01046-60201	Wire Color	Pin Agilent module	Signal Name	Active (TTL)
	White	1	Digital ground	
	Brown	2	Prepare run	Low
	Gray	3	Start	Low
	Blue	4	Shut down	Low
	Pink	5	Not connected	
	Yellow	6	Power on	High
	Red	7	Ready	High
	Green	8	Stop	Low
	Black	9	Start request	Low

CAN/LAN Cables



Both ends of this cable provide a modular plug to be connected to Agilent modules CAN or LAN connectors.

CAN Cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

LAN Cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

Agilent Module to PC

p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

USB Cables

To connect a USB Flash Drive use a USB OTG cable with Mini-B plug and A socket.

p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

10
Hardware Information

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This chapter describes the pump in more detail on hardware and electronics.

Firmware Description

The firmware of the instrument consists of two independent sections:

- a non-instrument specific section, called *resident system*
- an instrument specific section, called *main system*

Resident System

This resident section of the firmware is identical for all Agilent 1100/1200/1220/1260/1290 series modules. Its properties are:

- the complete communication capabilities (CAN, LAN, USB and RS-232C)
- memory management
- ability to update the firmware of the 'main system'

Main System

Its properties are:

- the complete communication capabilities (CAN, LAN, USB and RS-232C)
- memory management
- ability to update the firmware of the 'resident system'

In addition the main system comprises the instrument functions that are divided into common functions like

- run synchronization through APG remote,
- error handling,
- diagnostic functions,
- or module specific functions like
  - internal events such as lamp control, filter movements,
  - raw data collection and conversion to absorbance.

Firmware Updates

Firmware updates can be done using the following tools (latest version should be used):

- Agilent Lab Advisor software with files on the hard disk (*)
- Firmware Update Tool with local files on the hard disk (*)
- Instant Pilot (G4208A) with files on a USB Flash Disk

(*) Required tools, firmware and documentation are available from the Agilent web:
http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

PPPP is the product number, for example, 1315B for the G1315B DAD,

R the firmware revision, for example, A for G1315B or B for the G1315C DAD,

VVV is the revision number, for example 650 is revision 6.50,

XXX is the build number of the firmware.

For instructions on firmware updates refer to section *Replacing Firmware* in chapter *"Maintenance"* or use the documentation provided with the *Firmware Update Tools*.

NOTE

Update of main system can be done in the resident system only. Update of the resident system can be done in the main system only.

Main and resident firmware must be from the same set.

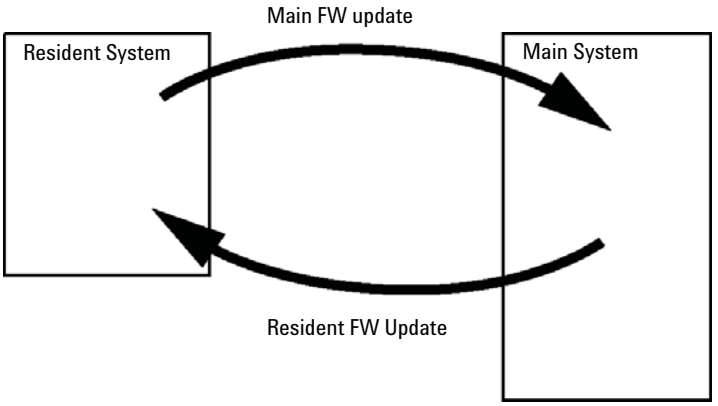

Figure 19 Firmware Update Mechanism

NOTE

Some modules are limited in downgrading due to their main board version or their initial firmware revision. For example, a G1315C DAD SL cannot be downgraded below firmware revision B.01.02 or to a A.xx.xx.

Some modules can be re-branded (e.g. G1314C to G1314B) to allow operation in specific control software environments. In this case the feature set of the target type are use and the feature set of the original are lost. After re-branding (e.g. from G1314B to G1314C), the original feature set is available again.

All these specific informations are described in the documentation provided with the firmware update tools.

The firmware update tools, firmware and documentation are available from the Agilent web.

- http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

Electrical Connections

- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- The REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch.
- The power input socket accepts a line voltage of 100 – 240 VAC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

NOTE Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Serial Number Information

The serial number information on the instrument labels provide the following information:

CCYWWSSSSS	Format
CC	country of manufacturing • DE = Germany • JP = Japan • CN = China
YWW	year and week of last major manufacturing change, e.g. 820 could be week 20 of 1998 or 2008
SSSSS	real serial number

Rear View of the Module

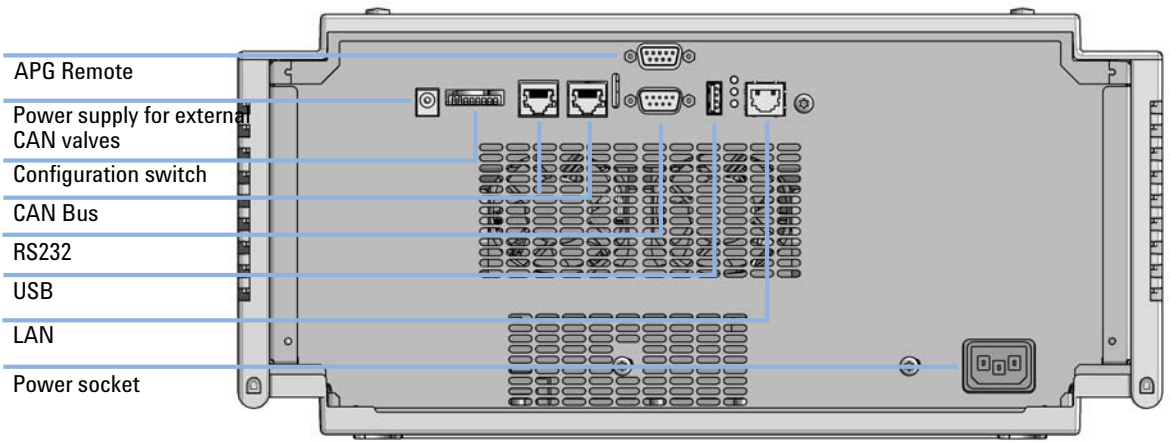

Figure 20 Rear view of the Flexible Pump

Interfaces

The Agilent 1200 Infinity Series II modules provide the following interfaces:

Table 4 Agilent 1200 Infinity II Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A Flexible Pump	2	No	Yes	Yes	1	A	
G7120A High Speed Pump	2	No	Yes	Yes	1	A	
Samplers							
G7129A/B ALS	2	Yes	Yes	No	No	E	
G7167A/B Multisampler	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B VWD	2	Yes	Yes	No	1	E	
G7117A/B DAD	2	Yes	Yes	No	1	E	
G7115A/B DAD	2	Yes	Yes	No	1	E	
Others							
G7116B MCT	2	No	No	No	No	No	Requires a HOST module via CAN

NOTE The detector (DAD/MWD/FLD/VWD/RID) is the preferred access point for control via LAN. The inter-module communication is done via CAN.

- CAN connectors as interface to other modules
- LAN connector as interface to the control software
- RS-232C as interface to a computer
- USB (Universal Series Bus) as interface to a computer
- REMOTE connector as interface to other Agilent products
- Analog output connector(s) for signal output

Overview Interfaces

CAN

The CAN is inter-module communication interface. It is a 2-wire serial bus system supporting high speed data communication and real-time requirement.

LAN

The modules have either an interface slot for an LAN card (e.g. Agilent G1369B/C LAN Interface) or they have an on-board LAN interface (e.g. detectors G1315C/D DAD and G1365C/D MWD). This interface allows the control of the module/system via a PC with the appropriate control software. Some modules have neither on-board LAN nor an interface slot for a LAN card (e.g. G1170A Valve Drive or G4227A Flex Cube). These are hosted modules and require a Host module with firmware B.06.40 or later or with additional G1369C LAN Card.

NOTE

If an Agilent detector (DAD/MWD/FLD/VWD/RID) is in the system, the LAN should be connected to the DAD/MWD/FLD/VWD/RID (due to higher data load). If no Agilent detector is part of the system, the LAN interface should be installed in the pump or autosampler.

RS-232C (Serial)

The RS-232C connector is used to control the module from a computer through RS-232C connection, using the appropriate software. This connector can be configured with the configuration switch module at the rear of the module. Refer to *Communication Settings for RS-232C*.

NOTE

There is no configuration possible on main boards with on-board LAN. These are pre-configured for

- 19200 baud,
- 8 data bit with no parity and
- one start bit and one stop bit are always used (not selectable).

The RS-232C is designed as DCE (data communication equipment) with a 9-pin male SUB-D type connector. The pins are defined as:

Table 5 RS-232C Connection Table

Pin	Direction	Function
1	In	DCD
2	In	RxD
3	Out	TxD
4	Out	DTR
5		Ground
6	In	DSR
7	Out	RTS
8	In	CTS
9	In	RI

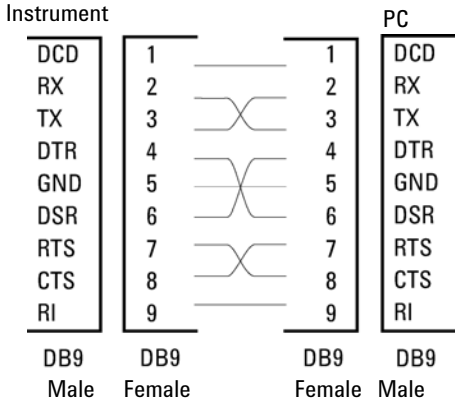

Figure 21 RS-232 Cable

Analog Signal Output

The analog signal output can be distributed to a recording device. For details refer to the description of the module's main board.

APG Remote

The APG Remote connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features as common shut down, prepare, and so on.

Remote control allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements.

The subminiature D connector is used. The module provides one remote connector which is inputs/outputs (wired- or technique).

To provide maximum safety within a distributed analysis system, one line is dedicated to **SHUT DOWN** the system's critical parts in case any module detects a serious problem. To detect whether all participating modules are switched on or properly powered, one line is defined to summarize the **POWER ON** state of all connected modules. Control of analysis is maintained by signal readiness **READY** for next analysis, followed by **START** of run and optional **STOP** of run triggered on the respective lines. In addition **PREPARE** and **START REQUEST** may be issued. The signal levels are defined as:

- standard TTL levels (0 V is logic true, + 5.0 V is false),
- fan-out is 10,
- input load is 2.2 kOhm against + 5.0 V, and
- output are open collector type, inputs/outputs (wired- or technique).

NOTE All common TTL circuits operate with a 5 V power supply. A TTL signal is defined as "low" or L when between 0 V and 0.8 V and "high" or H when between 2.0 V and 5.0 V (with respect to the ground terminal).

Table 6 Remote Signal Distribution

Pin	Signal	Description
1	DGND	Digital ground
2	PREPARE	(L) Request to prepare for analysis (for example, calibration, detector lamp on). Receiver is any module performing pre-analysis activities.
3	START	(L) Request to start run / timetable. Receiver is any module performing run-time controlled activities.
4	SHUT DOWN	(L) System has serious problem (for example, leak: stops pump). Receiver is any module capable to reduce safety risk.
5		Not used
6	POWER ON	(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.
7	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
8	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
9	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.

Special Interfaces

The module includes a DC-Out (24 VDC) power line that is intended to be used with certain modules that operate as CAN slaves, for example external valves. The line has a limited output of 1.7 A and is self resetting.

Setting the 8-bit Configuration Switch

The 8-bit configuration switch is located at the rear of the module. Switch settings provide configuration parameters for LAN, serial communication protocol and instrument specific initialization procedures.

All modules with on-board LAN:

- Default is ALL switches DOWN (best settings).
  - Bootp mode for LAN and
  - 19200 baud, 8 data bit / 1 stop bit with no parity for RS-232
- For specific LAN modes switches 3-8 must be set as required.
- For boot/test modes switches 1+2 must be UP plus required mode.

NOTE For normal operation use the default (best) settings.

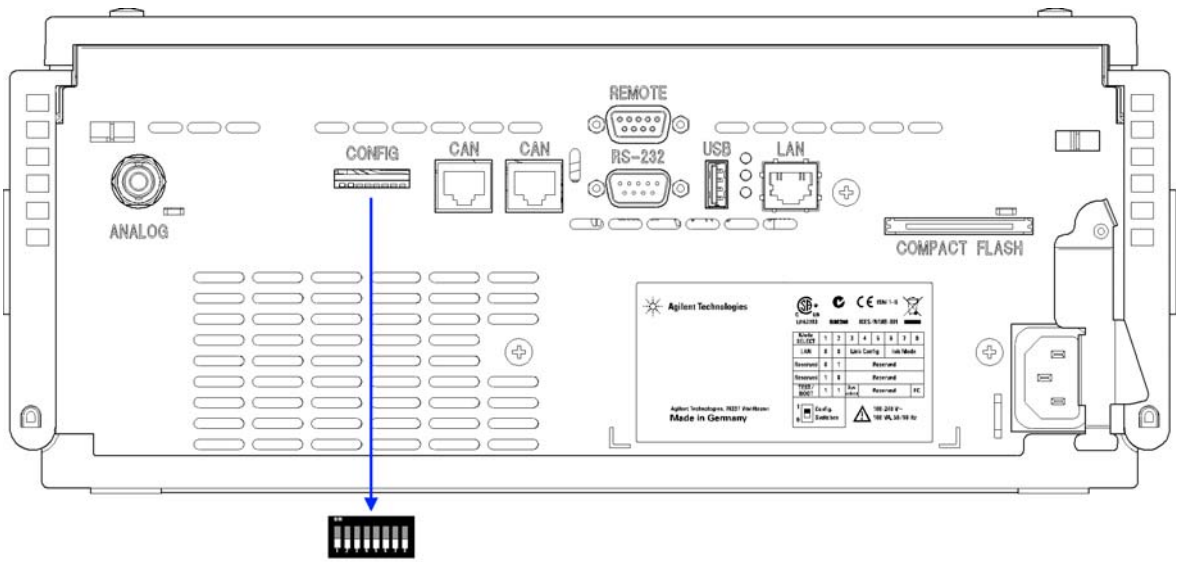

Figure 22 Location of Configuration Switch (example shows a G4212A DAD)

NOTE To perform any LAN configuration, SW1 and SW2 must be set to OFF. For details on the LAN settings/configuration refer to chapter LAN Configuration.

Table 7 8-bit Configuration Switch (with on-board LAN)

	Mode		Function					
	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
LAN	*0*	*0*	Link Configuration			Init Mode Selection		
Auto-negotiation			*0*	x	x	x	x	x
10 MBit, half-duplex			1	*0*	*0*	x	x	x
10 MBit, full-duplex			1	*0*	1	x	x	x
100 MBit, half-duplex			1	1	*0*	x	x	x
100 MBit, full-duplex			1	1	1	x	x	x
Bootp			x	x	x	*0*	*0*	*0*
Bootp & Store			x	x	x	*0*	*0*	1
Using Stored			x	x	x	*0*	1	*0*
DHCP			x	x	x	1	*0*	*0*
Using Default			x	x	x	*0*	1	1
TEST	1	1	System					NVRAM
Boot Resident System			1					x
Revert to Default Data (Coldstart)			x	x	x			1

Legend:

0 (switch down), 1 (switch up), x (any position)

NOTE When selecting the mode TEST, the LAN settings are: Auto-Negotiation & Using Stored.

NOTE For explanation of "Boot Resident System" and "Revert to Default Data (Coldstart)" refer to "Special Settings" on page 186.

Special Settings

The special settings are required for specific actions (normally in a service case).

NOTE The tables include both settings for modules – with on-board LAN and without on-board LAN. They are identified as LAN and no LAN.

Boot-Resident

Firmware update procedures may require this mode in case of firmware loading errors (main firmware part).

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident mode. It is not operable as a module. It only uses basic functions of the operating system for example, for communication. In this mode the main firmware can be loaded (using update utilities).

Table 8 Boot Resident Settings (On-board LAN)

Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
TEST/BOOT	1	1	1	0	0	0	0	0

Forced Cold Start

A forced cold start can be used to bring the module into a defined mode with default parameter settings.

CAUTION Loss of data

Forced cold start erases all methods and data stored in the non-volatile memory. Exceptions are calibration settings, diagnosis and repair log books which will not be erased.

➔ Save your methods and data before executing a forced cold start.

If you use the following switch settings and power the instrument up again, a forced cold start has been completed.

Table 9 Forced Cold Start Settings (On-board LAN)

Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
TEST/BOOT	1	1	0	0	0	0	0	1

Early Maintenance Feedback

Maintenance requires the exchange of components which are subject to wear or stress. Ideally, the frequency at which components are exchanged should be based on the intensity of usage of the module and the analytical conditions, and not on a predefined time interval. The early maintenance feedback (**EMF**) feature monitors the usage of specific components in the instrument, and provides feedback when the user-selectable limits have been exceeded. The visual feedback in the user interface provides an indication that maintenance procedures should be scheduled.

EMF Counters

EMF counters increment with use and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. Some counters can be reset to zero after the required maintenance procedure.

Using the EMF Counters

The user-settable **EMF** limits for the **EMF Counters** enable the early maintenance feedback to be adapted to specific user requirements. The useful maintenance cycle is dependent on the requirements for use. Therefore, the definition of the maximum limits need to be determined based on the specific operating conditions of the instrument.

Setting the EMF Limits

The setting of the **EMF** limits must be optimized over one or two maintenance cycles. Initially the default **EMF** limits should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by the **EMF counters**. Enter these values (or values slightly less than the displayed values) as **EMF** limits, and then reset the **EMF counters** to zero. The next time the **EMF counters** exceed the new **EMF** limits, the **EMF** flag will be displayed, providing a reminder that maintenance needs to be scheduled.

Instrument Layout

The industrial design of the module incorporates several innovative features. It uses Agilent's E-PAC concept for the packaging of electronics and mechanical assemblies. This concept is based upon the use of expanded polypropylene (EPP) layers of foam plastic spacers in which the mechanical and electronic boards components of the module are placed. This pack is then housed in a metal inner cabinet which is enclosed by a plastic external cabinet. The advantages of this packaging technology are:

- virtual elimination of fixing screws, bolts or ties, reducing the number of components and increasing the speed of assembly/disassembly,
- the plastic layers have air channels molded into them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronic and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the instrument itself.

11
LAN Configuration

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This chapter provides information on connecting the module to the controller software.

What You Have To Do First

The module has an on-board LAN communication interface.

1 Note the MAC (Media Access Control) address for further reference. The MAC or hardware address of the LAN interfaces is a world wide unique identifier. No other network device will have the same hardware address. The MAC address can be found on a label at the rear of the module underneath the configuration switch (see Figure 24 on page 190).

Figure 23 MAC label

2 Connect the instrument's LAN interface (see Figure 24 on page 190) to
- the PC network card using a crossover network cable (point-to-point) or
- a hub or switch using a standard LAN cable.

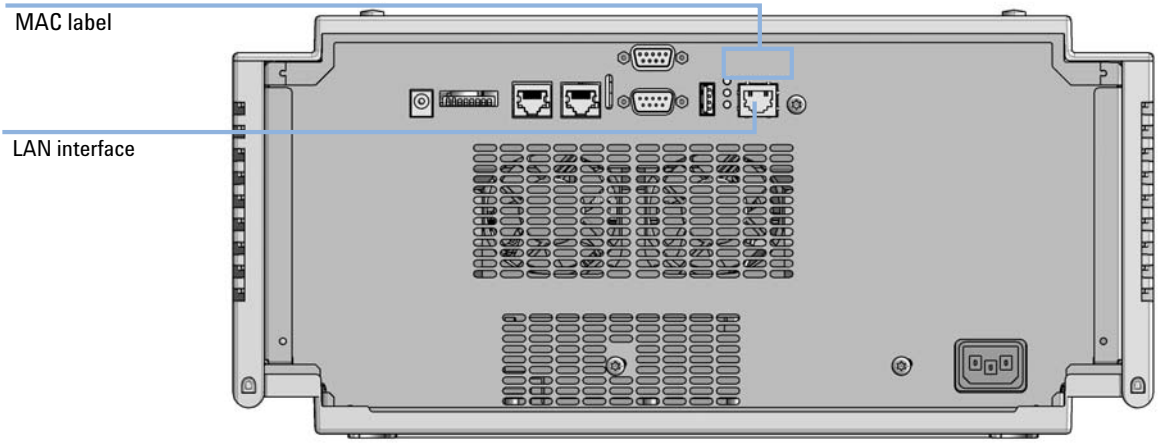


Figure 24 Location of LAN interfaces and MAC label

TCP/IP Parameter Configuration

To operate properly in a network environment, the LAN interface must be configured with valid TCP/IP network parameters. These parameters are:

- IP address
- Subnet Mask
- Default Gateway

The TCP/IP parameters can be configured by the following methods:

- by automatically requesting the parameters from a network-based BOOTP Server (using the so-called Bootstrap Protocol)
- by automatically requesting the parameters from a network-based DHCP Server (using the so-called Dynamic Host Configuration Protocol). This mode requires a LAN-onboard Module or a G1369C LAN Interface card, see "Setup (DHCP)" on page 198
- by manually setting the parameters using Telnet
- by manually setting the parameters using the Instant Pilot (G4208A)

The LAN interface differentiates between several initialization modes. The initialization mode (short form 'init mode') defines how to determine the active TCP/IP parameters after power-on. The parameters may be derived from a Bootp cycle, non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see Table 11 on page 193.

Configuration Switch

The configuration switch can be accessed at the rear of the module.

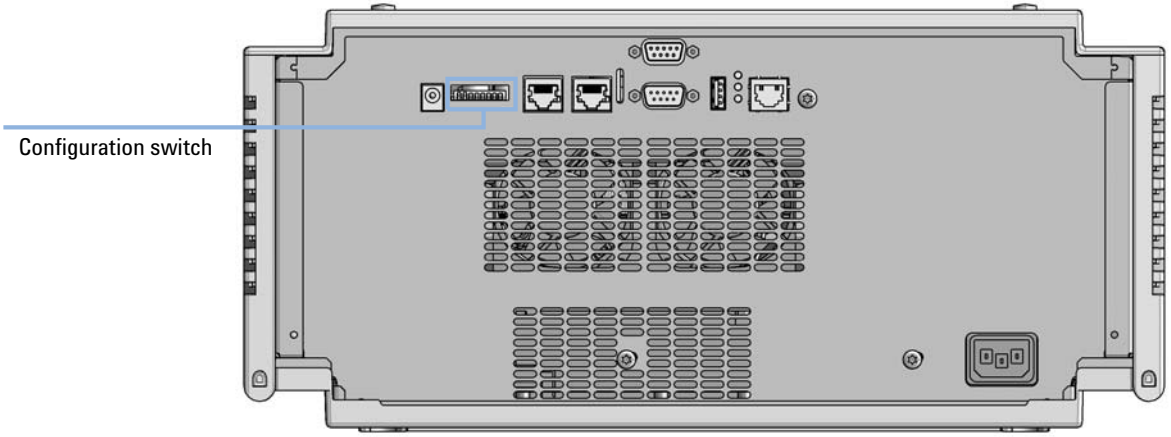


Figure 25 Location of Configuration Switch

The module is shipped with all switches set to OFF, as shown above.

NOTE To perform any LAN configuration, SW1 and SW2 must be set to OFF.

Table 10 Factory Default Settings

Initialization ('Init') Mode	Bootp, all switches down. For details see "Initialization Mode Selection" on page 193
Link Configuration	speed and duplex mode determined by auto-negotiation, for details see "Link Configuration Selection" on page 200

Initialization Mode Selection

The following initialization (init) modes are selectable:

Table 11 Initialization Mode Switches

	SW 6	SW 7	SW 8	Init Mode
	OFF	OFF	OFF	Bootp
	OFF	OFF	ON	Bootp & Store
	OFF	ON	OFF	Using Stored
	OFF	ON	ON	Using Default
	ON	OFF	OFF	DHCP [1]

[1] Requires firmware B.06.40 or above. Modules without LAN on board, see G1369C LAN Interface Card

Bootp

When the initialization mode **Bootp** is selected, the module tries to download the parameters from a **Bootp** Server. The parameters obtained become the active parameters immediately. They are not stored to the non-volatile memory of the module. Therefore, the parameters are lost with the next power cycle of the module.

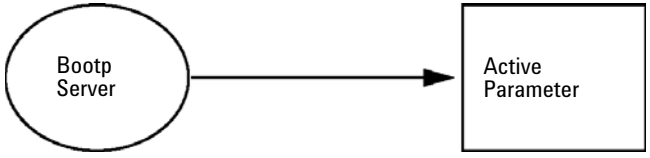


Figure 26 **Bootp** (Principle)

Bootp & Store

When **Bootp & Store** is selected, the parameters obtained from a **Bootp** Server become the active parameters immediately. In addition, they are stored to the non-volatile memory of the module. Thus, after a power cycle they are still available. This enables a kind of bootp once configuration of the module.

Example: The user may not want to have a **Bootp** Server be active in his network all the time. But on the other side, he may not have any other configuration method than **Bootp**. In this case he starts the **Bootp** Server temporarily, powers on the module using the initialization mode **Bootp & Store**, waits for the **Bootp** cycle to be completed, closes the **Bootp** Server and powers off the module. Then he selects the initialization mode Using Stored and powers on the module again. From now on, he is able to establish the TCP/IP connection to the module with the parameters obtained in that single **Bootp** cycle.

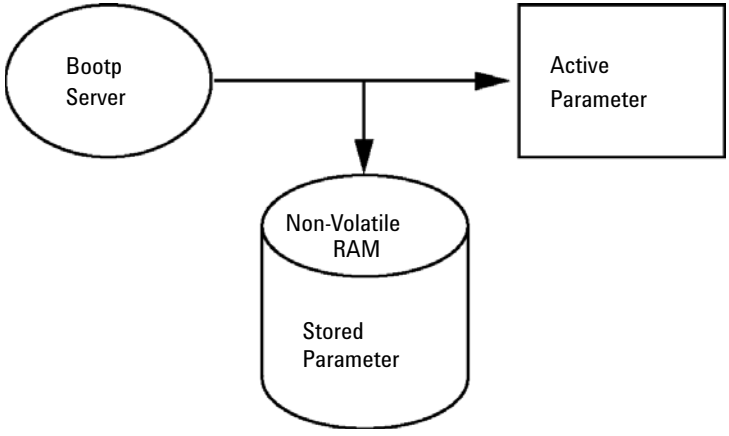


Figure 27 Bootp & Store (Principle)

NOTE Use the initialization mode **Bootp & Store** carefully, because writing to the non-volatile memory takes time. Therefore, when the module shall obtain its parameters from a **Bootp** Server every time it is powered on, the recommended initialization mode is **Bootp**!

Using Stored

When initialization mode **Using Stored** is selected, the parameters are taken from the non-volatile memory of the module. The TCP/IP connection will be established using these parameters. The parameters were configured previously by one of the described methods.

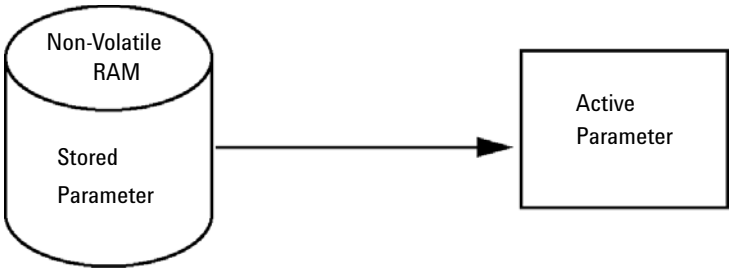


Figure 28 Using Stored (Principle)

Using Default

When **Using Default** is selected, the factory default parameters are taken instead. These parameters enable a TCP/IP connection to the LAN interface without further configuration, see Table 12 on page 195.

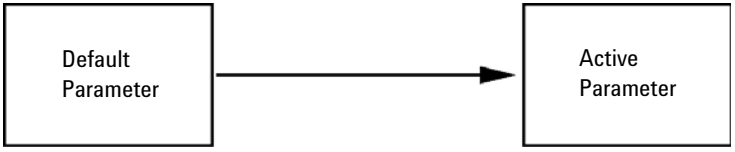


Figure 29 Using Default (Principle)

NOTE Using the default address in your local area network may result in network problems. Take care and change it to a valid address immediately.

Table 12 Using Default Parameters

IP address:	192.168.254.11
Subnet Mask:	255.255.255.0
Default Gateway	not specified

Since the default IP address is a so-called local address, it will not be routed by any network device. Thus, the PC and the module must reside in the same subnet.

The user may open a Telnet session using the default IP address and change the parameters stored in the non-volatile memory of the module. He may then close the session, select the initialization mode Using Stored, power-on again and establish the TCP/IP connection using the new parameters.

When the module is wired to the PC directly (e.g. using a cross-over cable or a local hub), separated from the local area network, the user may simply keep the default parameters to establish the TCP/IP connection.

NOTE

In the **Using Default** mode, the parameters stored in the memory of the module are not cleared automatically. If not changed by the user, they are still available, when switching back to the mode Using Stored.

Dynamic Host Configuration Protocol (DHCP)

General Information (DHCP)

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card, and "B"-firmware (B.06.40 or above).

When the initialization mode "DHCP" is selected, the card tries to download the parameters from a DHCP Server. The parameters obtained become the active parameters immediately. They are not stored to the non-volatile memory of the card.

Besides requesting the network parameters, the card also submits its hostname to the DHCP Server. The hostname equals the MAC address of the card, e.g. *0030d3177321*. It is the DHCP server's responsibility to forward the hostname/address information to the Domain Name Server. The card does not offer any services for hostname resolution (e.g. NetBIOS).

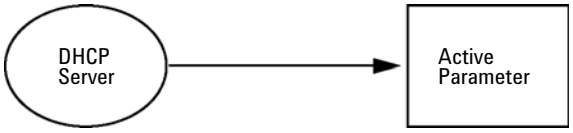


Figure 30 DHCP (Principle)

NOTE

1. It may take some time until the DHCP server has updated the DNS server with the hostname information.
2. It may be necessary to fully qualify the hostname with the DNS suffix, e.g. *0030d3177321.country.company.com*.
3. The DHCP server may reject the hostname proposed by the card and assign a name following local naming conventions.

Setup (DHCP)

Software required The modules in the stack must have at least firmware from set A.06.34 and the above mentioned modules B.06.40 or above (must from the same firmware set).

1 Note the MAC address of the LAN interface (provided with G1369C LAN Interface Card or Main Board). This MAC address is on a label on the card or at the rear of the main board, e.g. *0030d3177321*.

On the Instant Pilot the MAC address can be found under **Details** in the LAN section.

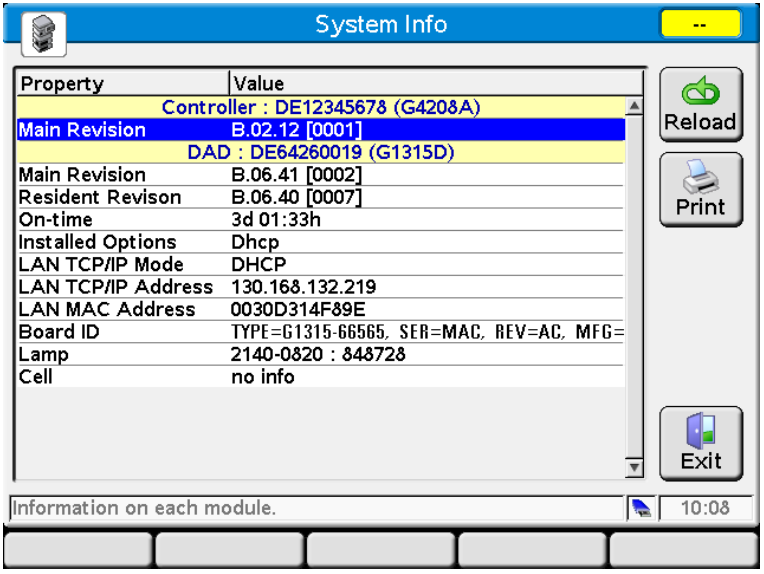


Figure 31 LAN Setting on Instant Pilot

2 Set the Configuration Switch to DHCP either on the G1369C LAN Interface Card or the main board of above mentioned modules.

Table 13 G1369C LAN Interface Card (configuration switch on the card)

SW 4	SW 5	SW 6	SW 7	SW 8	Initialization Mode
ON	OFF	OFF	OFF	OFF	DHCP

Table 14 LC Modules inclusive 1120/1220 (configuration switch at rear of the instrument)

SW 6	SW 7	SW 8	Initialization Mode
ON	OFF	OFF	DHCP

3 Turn on the module that hosts the LAN interface.

4 Configure your Control Software (e.g. Agilent ChemStation, Lab Advisor, Firmware Update Tool) and use MAC address as host name, e.g. *0030d3177321*.

The LC system should become visible in the control software (see Note in section "General Information (DHCP)" on page 197).

Link Configuration Selection

The LAN interface supports 10 or 100 Mbps operation in full- or half-duplex modes. In most cases, full-duplex is supported when the connecting network device - such as a network switch or hub - supports IEEE 802.3u auto-negotiation specifications.

When connecting to network devices that do not support auto-negotiation, the LAN interface will configure itself for 10- or 100-Mbps half-duplex operation.

For example, when connected to a non-negotiating 10-Mbps hub, the LAN interface will be automatically set to operate at 10-Mbps half-duplex.

If the module is not able to connect to the network through auto-negotiation, you can manually set the link operating mode using link configuration switches on the module.

Table 15 Link Configuration Switches

	SW 3	SW 4	SW 5	Link Configuration
	OFF	-	-	speed and duplex mode determined by auto-negotiation
	ON	OFF	OFF	manually set to 10 Mbps, half-duplex
	ON	OFF	ON	manually set to 10 Mbps, full-duplex
	ON	ON	OFF	manually set to 100 Mbps, half-duplex
	ON	ON	ON	manually set to 100 Mbps, full-duplex

Automatic configuration with Bootp

NOTE All examples shown in this chapter will not work in your environment. You need your own IP-, Subnet-Mask- and Gateway addresses.

NOTE Assure that the detector configuration switch is set properly. The setting should be either **BootP** or **BootP & Store**, see Table 11 on page 193.

NOTE Assure that the detector connected to the network is powered off.

NOTE If the Agilent BootP Service program is not already installed on your PC, then install it from your Agilent ChemStation DVD, located in folder **BootP**.

About Agilent BootP Service

The Agilent BootP Service is used to assign the LAN Interface with an IP address.

The Agilent BootP Service is provided on the ChemStation DVD. The Agilent BootP Service is installed on a server or PC on the LAN to provide central administration of IP addresses for Agilent instruments on a LAN. The BootP service must be running TCP/IP network protocol and cannot run a DHCP server.

How BootP Service Works

When an instrument is powered on, an LAN Interface in the instrument broadcasts a request for an IP address or host name and provides its hardware MAC address as an identifier. The Agilent BootP Service answers this request and passes a previously defined IP address and host name associated with the hardware MAC address to the requesting instrument.

The instrument receives its IP address and host name and maintains the IP address as long as it is powered on. Powering down the instrument causes it to lose its IP address, so the Agilent BootP Service must be running every time the instrument powers up. If the Agilent BootP Service runs in the background, the instrument will receive its IP address on power-up.

The Agilent LAN Interface can be set to store the IP address and will not lose the IP address if power cycled.

Situation: Cannot Establish LAN Communication

If a LAN communication with BootP service cannot be established, check the following on the PC:

- Is the BootP service started? During installation of BootP, the service is not started automatically.
- Does the Firewall block the BootP service? Add the BootP service as an exception.
- Is the LAN Interface using the BootP-mode instead of "Using Stored" or "Using Default" modes?

Installation of BootP Service

Before installing and configuring the Agilent BootP Service, be sure to have the IP addresses of the computer and instruments on hand.

1 Log on as Administrator or other user with Administrator privileges.

2 Close all Windows programs.

3 Insert the Agilent ChemStation software DVD into the drive. If the setup program starts automatically, click **Cancel** to stop it.

4 Open Windows Explorer.

5 Go to the BootP directory on the Agilent ChemStation DVD and double-click **BootPPackage.msi**.

6 If necessary, click the **Agilent BootP Service...** icon in the task bar.

7 The **Welcome** screen of the **Agilent BootP Service Setup Wizard** appears. Click **Next**.

8 The **End-User License Agreement** screen appears. Read the terms, indicate acceptance, then click **Next**.

9 The **Destination Folder** selection screen appears. Install BootP to the default folder or click **Browse** to choose another location. Click **Next**.

The default location for installation is:

C:\Program Files\Agilent\BootPService\

10 Click **Install** to begin installation.

11 Files load; when finished, the **BootP Settings** screen appears.

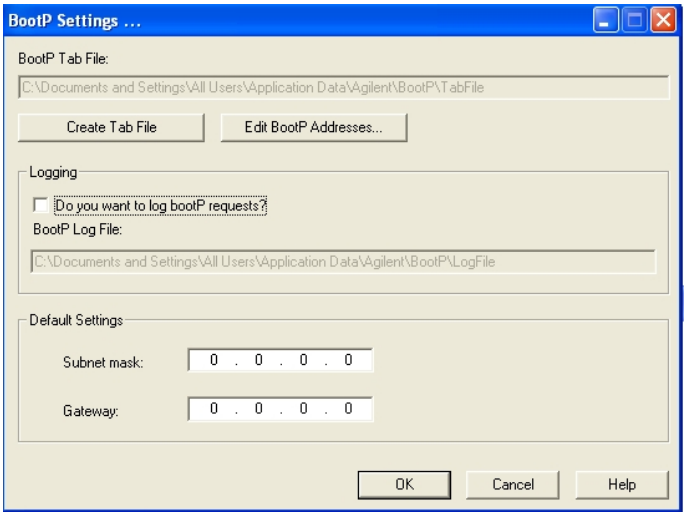


Figure 32 BootP Settings screen

12 In the **Default Settings** part of the screen, if known, you can enter the subnet mask and gateway.

Defaults can be used:

- The default subnet mask is 255.255.255.0
- The default gateway is 192.168.254.11

13 On the **BootP Settings** screen, click **OK**. The **Agilent BootP Service Setup** screen indicates completion.

14 Click **Finish** to exit the **Agilent BootP Service Setup** screen.

15 Remove the DVD from the drive.

This completes installation.

16 Start BootP Service in the Windows® services: On the Windows® desktop click right on **Computer** icon, select **Manage > Services and Applications > Services**. Select the **Agilent BootP Service** and click **Start**.

Two Methods to Determine the MAC Address

Enabling logging to discover the MAC address using BootP

If you want to see the MAC address, select the **Do you want to log BootP requests?** check box.

1 Open BootP Settings from **Start > All Programs > Agilent BootP Service > EditBootPSettings**.

2 In **BootP Settings...** check **Do you want to log BootP requests?** to enable logging.

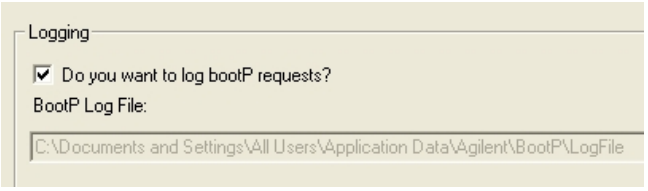

Logging
Do you want to log bootP requests?
BootP Log File:
C:\Documents and Settings\All Users\Application Data\Agilent\BootP\LogFile

Figure 33 Enable BootP logging

The log file is located in

C:\Documents and Settings\All Users\Application Data\Agilent\BootP\LogFile

It contains a MAC address entry for each device that requests configuration information from BootP.

3 Click **OK** to save the values or **Cancel** to discard them. The editing ends.

4 After each modification of the BootP settings (i.e. **EditBootPSettings**) a stop or start of the BootP service is required for the BootP service to accept changes. See "Stopping the Agilent BootP Service" on page 209 or "Restarting the Agilent BootP Service" on page 210.

5 Uncheck the **Do you want to log BootP requests?** box after configuring instruments; otherwise, the log file will quickly fill up disk space.

Determining the MAC address directly from the LAN Interface card label

1 Turn off the instrument.

2 Read the MAC address from the label and record it.

The MAC address is printed on a label on the rear of the module.

3 Read the MAC address from the label and record it.

The MAC address is printed on a label on the rear of the module.

See Figure 23 on page 190 and Figure 24 on page 190.

4 Turn on the instrument.

Assigning IP Addresses Using the Agilent BootP Service

The Agilent BootP Service assigns the Hardware MAC address of the instrument to an IP address.

Determining the MAC address of the instrument using BootP Service

1 Power cycle the Instrument.

2 After the instrument completes self-test, open the log file of the BootP Service using Notepad.

- The default location for the logfile is C:\Documents and Settings\All Users\Application Data\Agilent\BootP\LogFile.
- The logfile will not be updated if it is open.

The contents will be similar to the following:

```
02/25/10 15:30:49 PM

Status: BootP Request received at outermost layer

Status: BootP Request received from hardware address: 0010835675AC

Error: Hardware address not found in BootPTAB: 0010835675AC

Status: BootP Request finished processing at outermost layer
```

3 Record the hardware (MAC) address (for example, 0010835675AC).

4 The Error means the MAC address has not been assigned an IP address and the Tab File does not have this entry. The MAC address is saved to the Tab File when an IP address is assigned.

5 Close the log file before turning on another instrument.

6 Uncheck the **Do you want to log BootP requests?** box after configuring instruments to avoid having the logfile use up excessive disk space.

Adding each instrument to the network using BootP

1 Follow **Start > All Programs > Agilent BootP Service** and select **Edit BootP Settings**. The BootP Settings screen appears.

2 Uncheck the **Do you want to log BootP requests?** once all instruments have been added.

The **Do you want to log BootP requests?** box must be unchecked when you have finished configuring instruments; otherwise, the log file will quickly fill up disk space.

3 Click **Edit BootP Addresses...** The **Edit BootP Addresses** screen appears.

4 Click **Add...** The **Add BootP Entry** screen appears.

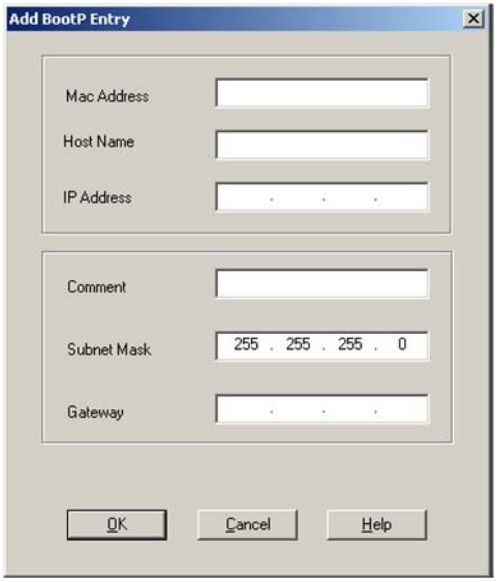


Figure 34 Enable BootP logging

5 Make these entries for the instrument:

- MAC address
- Host name, Enter a Hostname of your choice.

  The Host Name must begin with "alpha" characters (i.e. LC1260)
- IP address
- Comment (optional)
- Subnet mask
- Gateway address (optional)

The configuration information entered is saved in the Tab File.

6 Click **OK**.

7 Leave **Edit BootP Addresses** by pressing **Close**.

8 Exit **BootP Settings** by pressing **OK**.

9 After each modification of the BootP settings (i.e. EditBootPSettings) a stop or start of the BootP service is required for the BootP service to accept changes. See "Stopping the Agilent BootP Service" on page 209 or "Restarting the Agilent BootP Service" on page 210.

10 Power cycle the Instrument.

OR

If you changed the IP address, power cycle the instrument for the changes to take effect.

11 Use the PING utility to verify connectivity by opening a command window and typing:

Ping 192.168.254.11 for example.

The Tab File is located at

C:\Documents and Settings\All Users\Application Data\Agilent\BootP\TabFile

Changing the IP Address of an Instrument Using the Agilent BootP Service

Agilent BootP Service starts automatically when your PC reboots. To change Agilent BootP Service settings, you must stop the service, make the changes, and then restart the service.

Stopping the Agilent BootP Service

1 From the Windows control panel, select **Administrative Tools > Services**. The **Services** screen appears.

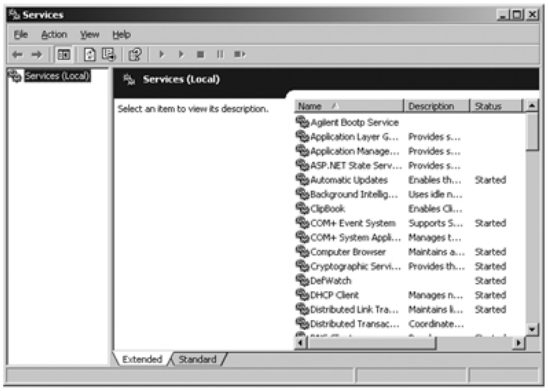


Figure 35 Windows Services screen

2 Right-click **Agilent BootP Service**.

3 Select **Stop**.

4 Close the **Services and Administrative Tools** screen.

Editing the IP address and other parameters in EditBootPSettings

1 Select **Start > All Programs > Agilent BootP Service** and select **Edit BootP Settings**. The **BootP Settings** screen appears.

2 When the **BootP Settings** screen is first opened, it shows the default settings from installation.

3 Press **Edit BootP Addresses...** to edit the Tab File.

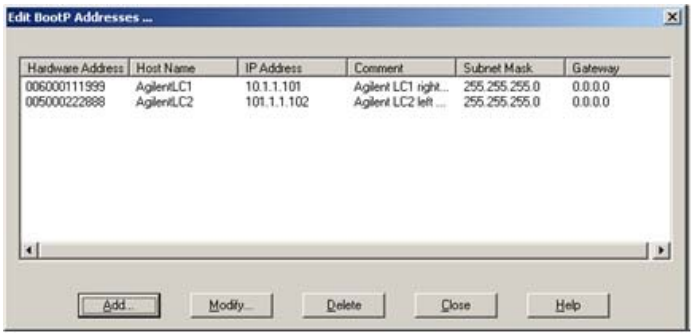


Figure 36 Edit BootP Adresses screen

4 In the **Edit BootP Addresses...** screen press **Add...** to create a new entry or select an existing line from the table and press **Modify...** or **Delete** to change the IP address, comment, subnet mask, for example, in the Tab File.

If you change the IP address, it will be necessary to power cycle the instrument for the changes to take effect.

5 Leave **Edit BootP Addresses...** by pressing **Close**.

6 Exit BootP Settings by pressing OK.

Restarting the Agilent BootP Service

1 In the Windows control panel, select **Administrative Tools > Services**. The **Services** screen appears, see Figure 35 on page 209.

2 Right-click **Agilent BootP Service** and select **Start**.

3 Close the **Services and Administrative Tools** screens.

Manual Configuration

Manual configuration only alters the set of parameters stored in the non-volatile memory of the module. It never affects the currently active parameters. Therefore, manual configuration can be done at any time. A power cycle is mandatory to make the stored parameters become the active parameters, given that the initialization mode selection switches are allowing it.

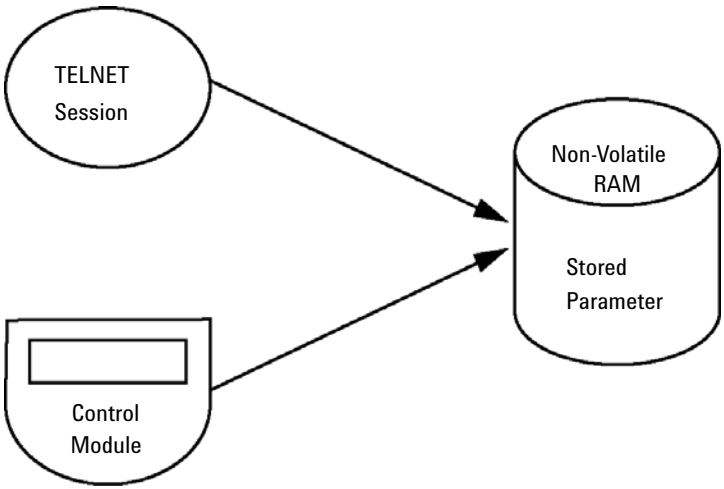


Figure 37 Manual Configuration (Principle)

With Telnet

Whenever a TCP/IP connection to the module is possible (TCP/IP parameters set by any method), the parameters may be altered by opening a Telnet session.

1 Open the system (DOS) prompt window by clicking on Windows **START** button and select **"Run..."**. Type "cmd" and press OK.

2 Type the following at the system (DOS) prompt:

- `c:\>telnet <IP address>` or
- `c:\>telnet <host name>`

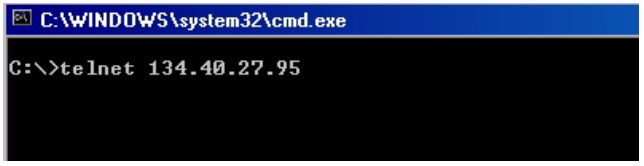


Figure 38 Telnet - Starting a session

where <IP address> may be the assigned address from a Bootp cycle, a configuration session with the Handheld Controller, or the default IP address (see "Configuration Switch" on page 192).

When the connection was established successfully, the module responds with the following:

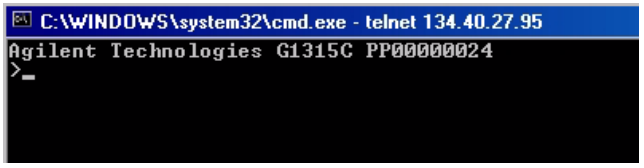


Figure 39 A connection to the module is made

3 Type
`?` and press enter to see the available commands.

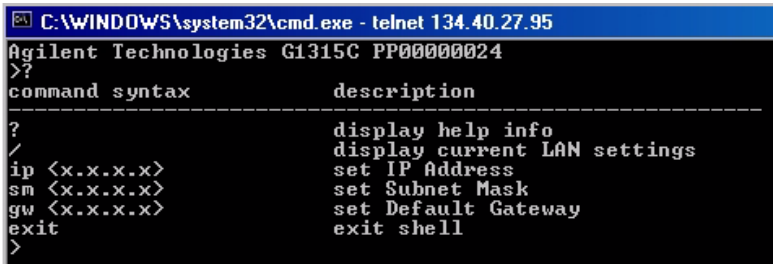


Figure 40 Telnet Commands

Table 16 Telnet Commands

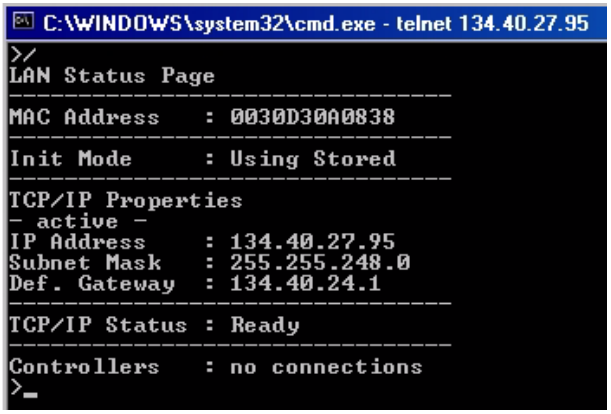
Value	Description
?	displays syntax and descriptions of commands
/	displays current LAN settings
ip <x.x.x.x>	sets new ip address
sm <x.x.x.x>	sets new subnet mask
gw <x.x.x.x>	sets new default gateway
exit	exits shell and saves all changes

4 To change a parameter follows the style:

- parameter value, for example:
  `ip 134.40.27.230`

Then press [Enter], where parameter refers to the configuration parameter you are defining, and value refers to the definitions you are assigning to that parameter. Each parameter entry is followed by a carriage return.

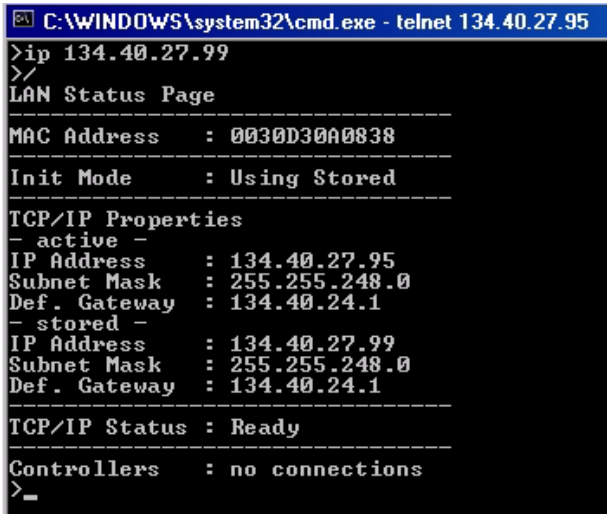
5 Use the “/” and press Enter to list the current settings.



information about the LAN interface
MAC address, initialization mode
Initialization mode is Using Stored
active TCP/IP settings
TCP/IP status - here ready
connected to PC with controller software (e.g. Agilent ChemStation), here not connected

Figure 41 Telnet - Current settings in "Using Stored" mode

6 Change the IP address (in this example 134.40.27.99) and type "/" to list current settings.



change of IP setting to
Initialization mode is Using Stored
active TCP/IP settings
stored TCP/IP settings in non-volatile memory

connected to PC with controller software (e.g. Agilent ChemStation), here not connected

Figure 42 Telnet - Change IP settings

7 When you have finished typing the configuration parameters, type **exit** and press **Enter** to exit with storing parameters.

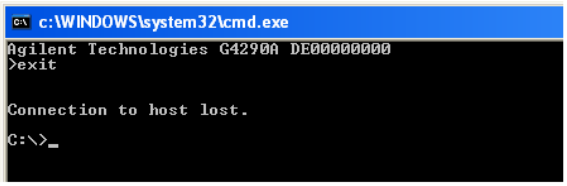


Figure 43 Closing the Telnet Session

NOTE If the Initialization Mode Switch is changed now to “Using Stored” mode, the instrument will take the stored settings when the module is re-booted. In the example above it would be 134.40.27.99.

PC and User Interface Software Setup Setup

PC Setup for Local Configuration

This procedure describes the change of the TCP/IP settings on your PC to match the module's default parameters in a local configuration (see also "Initialization Mode Selection" on page 193).

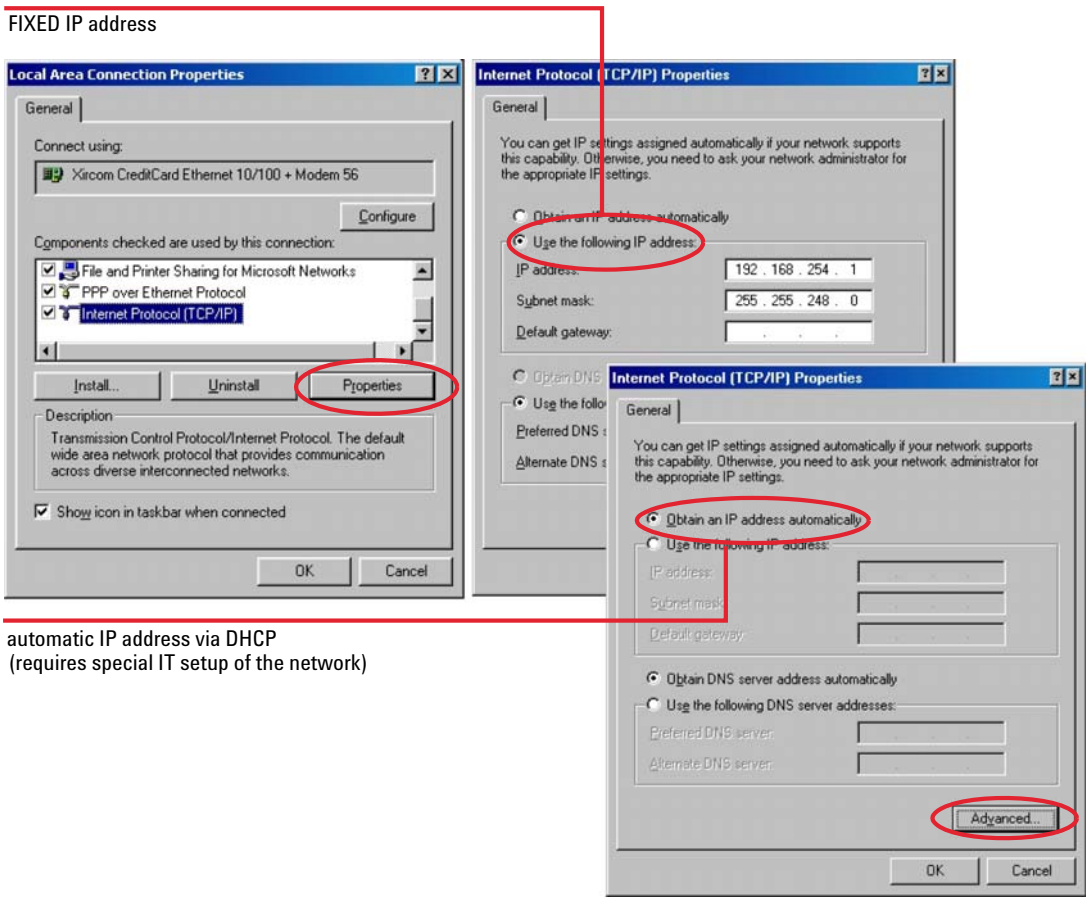

FIXED IP address
Local Area Connection Properties
General
Connect using:
Xircom CreditCard Ethernet 10/100 + Modem 56
Configure
Components checked are used by this connection:
File and Printer Sharing for Microsoft Networks
PPP over Ethernet Protocol
Internet Protocol (TCP/IP)
Install...
Uninstall
Properties
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in taskbar when connected
OK
Cancel
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Use the following IP address:
IP address:
192 . 168 . 254 . 1
Subnet mask:
255 . 255 . 248 . 0
Default gateway:
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel
automatic IP address via DHCP
(requires special IT setup of the network)

Figure 44 Changing the TCP/IP settings of the PC

User Interface Software Setup

Install you user interface software according the provided *User Interface Software Setup Guide*.

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This chapter provides additional information on safety, legal and web.

General Safety Information

General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

➔ The operator of this instrument is advised to use the equipment in a manner as specified in this manual.

Safety Standards

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

- ➔ Verify that the voltage range and frequency of your power distribution matches to the power specification of the individual instrument.
- ➔ Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.
- ➔ Make all connections to the unit before applying power.

NOTE

Note the instrument's external markings described under "Safety Symbols" on page 224.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

- ➔ If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard.
- ➔ The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

➔ Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

➔ Do Not Remove the Instrument Cover

➔ Only Agilent authorized personnel are allowed to remove instrument covers. Always disconnect the power cables and any external circuits before removing the instrument cover.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

➔ Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

- ➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
- ➔ The volume of substances should be reduced to the minimum required for the analysis.
- ➔ Do not operate the instrument in an explosive atmosphere.
- ➔ Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.
- ➔ Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.
- ➔ Arrange the bottles as specified in the usage guideline for the solvent cabinet.
- ➔ A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.
- ➔ Ground the waste container.
- ➔ The residual free volume in the appropriate waste container must be large enough to collect the waste liquid.
- ➔ Check the filling level of the waste container regularly.
- ➔ To achieve maximal safety, check the correct installation regularly.
- ➔ Do not use solvents with an auto-ignition temperature below 200 °C (392 °F).

Safety Symbols

Table 17 Symbols

	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.
	Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: http://regulations.corporate.agilent.com/DoC/search.htm
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position

Table 17 Symbols

	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.
	Magnetic field Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.
	Indicates a pinching or crushing hazard
	Indicates a piercing or cutting hazard.

WARNING

A WARNING

alerts you to situations that could cause physical injury or death.

➔ Do not proceed beyond a warning until you have fully understood and met the indicated conditions.

CAUTION

A CAUTION

alerts you to situations that could cause loss of data, or damage of equipment.

➔ Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Waste Electrical and Electronic Equipment Directive

Abstract

The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC), adopted by EU Commission on 13 February 2003, is introducing producer responsibility on all electric and electronic appliances starting with 13 August 2005.

NOTE

This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category:

With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a Monitoring and Control Instrumentation product.

NOTE

Do not dispose of in domestic household waste

To return unwanted products, contact your local Agilent office, or see www.agilent.com for more information.

Radio Interference

Cables supplied by Agilent Technologies are screened to provide optimized protection against radio interference. All cables are in compliance with safety or EMC regulations.

Test and Measurement

If test and measurement equipment is operated with unscreened cables, or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Sound Emission

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

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http://www.agilent.com

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In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II Flexible Pump G7104A.

The manual describes the following:

- Introduction,
- Site requirements and specifications,
- using and optimizing,
- troubleshooting and diagnostic,
- error information,
- test functions,
- maintenance,
- parts identification,
- hardware information,
- safety and related information.

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